The Electrical World.

VOL. XXVIII. NEW YORK, OCTOBER 10, 1896. No. 15.

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY,

253 Broadway, New York.

Established 1874. Incorporated 1889.

Telephone Call: Cortlandt 924. Cable Address: "Electrical," New York

New England Office, 620 Atlantic Ave., Boston.

Western Office, 936 Monadnock Block, Chicago.

Philadelphia Office, 927 Chestnut Street.

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THE ELECTRICAL WORLD,

253 Broadway, New York.

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STORAGE BATTERIES FOR ELECTRIC TRACTION PURPOSES.

As will be noticed by reading President Duncan's inaugural address before the American Institute of Electrical Engineers, the first installment of which appears in this issue, the storage battery is considered as one of the most important factors in the distribution of electrical energy, and its use is advocated especially in connection with electric railway extensions. The advantages which may be derived from the use of storage batteries in connection with direct-current systems of supply are so well recognized that it cannot be considered due so much to the want of appreciation on the part of American engineers of their valuable features that they have not been more extensively used in this country, as to the want of faith in their durability. The experience of European engineers with batteries, both in lighting and electric traction stations has been very successful, and the more extended use now being made of them in central stations in this country is producing such favorable results that they will certainly have a much larger employment in the future. In its application to electric railway systems, the present conditions in this country are not so promising. Thus far every attempt to use batteries independent of line conductors for street car traction purposes has resulted in failure, and even when located in the power-station have had a similar verdict pronounced upon them by an eminent authority. The extensive railway field which is open to the successful storage battery demands that considerations other than those of its manufacturers should be most carefully examined. A correspondent to the London *Electrician* states that six years' experience with storage batteries in a water-power plant has proven that the various types of positive plates become rotten and fall to pieces. The Planté high surface type is the one which now commands the greatest favor and will doubtless have the most extensive use in the future, so that the problem before engineers is to reduce to a minimum the cost of its renewal. If batteries eventually become extensively used for electric traction purposes, the question arises whether it will not pay the street railway manager to adopt facilities for replacing positive plates as he now repairs other parts of his railway equipment. If the simple Planté type is used it certainly would not be impracticable to cast the plates in the railway repair shop and thus make renewals, which would reduce considerably the maintenance account. The demands placed upon electric railway extensions can best be met by the storage battery, and inasmuch as the positive plate is bound to deteriorate if existing conditions are to be considered as a criterion the only expedient is to employ the cheapest form of plate obtainable and prepare to replace it as frequently as required under the most economical conditions.

TO PREVENT THE LAYING OF A SUBMARINE CABLE.

A serious charge has been filed in the United States Circuit Court in New York City, against three cable companies, two of which are domestic and the third foreign. The complainant in the case is the United States Government, and the charge is that the defendant companies are combining and conspiring for the purpose of monopolizing a part of the trade and commerce between the United States and the several States thereof and foreign nations, to the irreparable injury of the people and business interests of this country. The facts are briefly as follows: La Compagnie Française des Cables Télégraphique, which controls and operates a submarine cable system between the United States and France, also a system in and between several of the West

Indian Islands and South American countries, has for several years been endeavoring to secure a connection of its own between the two systems. The United States Government, however, has refused permission to land the new cable on the United States soil, except on the condition that the French company shall surrender its cable monopoly between the United States and the West Indies and South American countries, which it holds by reason of the exclusive rights granted by these several foreign countries. To accede to this demand means the loss of a subsidy of 800,000 francs per annum, which the French Government agreed to pay the company for a period of 30 years, on condition that the latter, within two years from Dec. 29, 1895, secures the connections desired. The United States Government interposed a serious obstacle in the carrying out of this scheme, and the company, it is alleged, is now trying to evade this objection by entering into an unlawful agreement with the two American companies to attain its desired object. The latter concerns are the United States and HaitiCable Company and the United States and Haiti Telegraph and Cable Company. The former company it is charged laid ten miles of cable from Coney Island out to sea, there to be connected with the West Indies cable, thus aiding in the circumvention of the objection of the United States Government. The United States & Haiti Telegraph & Cable Company, it is stated, is the successor of the former company, and has for its purpose to assist the French cable company to achieve its unlawful objects. This is substantially the complaint. A feature of the case is that those prominently identified with the American companies stand high in reputation and esteem in our business community and that such a charge should be entered against them is a serious and unfortunate matter. There was an evident disposition among the several parties to at once make a public statement from their standpoint, but after reconsidering the matter, it was decided to wait until the trial of the case when their position would be fully set forth. It seems incredible that those against whom the charge is made should so endanger their reputation as to become entangled in such an unpatriotic and unbusinesslike alliance, and we hope that they will succeed in clearing themselves of the charge. Referring to the general subject, it is interesting to note that a French cable steamer arrived at Hampton Roads a few days ago, having on board 1100 miles of cable to be laid between New York and Turk's Island, and the opinion prevails that the complaint of the United States Government comes too late to accomplish its purpose.

EXPERT TESTIMONY.

Within comparatively recent years there has arisen in our judicial system an apparent need for evidence bearing upon scientific questions requiring a knowledge not ordinarily possessed by the lay witness, and which is gradually being more and more supplied by the so-called "expert." He is paid to testify on behalf of one side or the other and not infrequently is retained to appear as often as cases arise in which his opinions are desired. That the most flagrant abuses in expert testimony have made themselves most prominent in criminal cases is perhaps to be attributed merely to the notoriety which these cases have attained. Whether it be the fault of our patent system or of our judicial system, the expert has become a prominent factor in all recent cases pertaining to patent litigation. It is not uncommon to find several experts on one side arrayed against perhaps as many more on the other, and if each side has been able to retain men of practically equal prominence, that side having the greater number frequently produces no little effect on influencing the judicial decision. That men devoted to the interest of science should be willing to sell their opinions indiscriminately to either contending party, often being obliged to so modify their views as to make them harmonize with the unscientific but legal opinions of the counsel by whom they are employed, has become an evil which has justly brought forth criticism, must be acknowledged, and unless modified or changed in some form, calls for the future condemnation also. In a contribution to the October number of the *Atlantic Monthly*, Prof. John Trowbridge calls attention to the imperiled dignity of science and the law if the practice of indiscriminate scientific testifying is to continue. He points out the difficulty in which a judge is placed when required to carefully weigh statements on scientific points; his attitude toward the scientific expert and the little regard he frequently holds for his opinions. He is therefore tempted to entirely ignore expert testimony and rely upon his own common sense for framing his decision. The consequence has been that judges may be classified under several headings, a classification based simply upon their legal decisions in the past, some being known as patent-breakers and others the most strenuous advocates of broad patent claims. It is for this reason that suits are carried from court to court with the ultimate hope that a former decision will be reversed. The result of this method has been well illustrated and can be vouched for by several of the larger manufacturing companies who have invested millions in this way during the past few years, with no immediate prospects of any material return on the investment. The chief benefit has been derived by patent lawyers and patent experts, while the stockholder has been forced to respond with the shekels. Prof. Trowbridge does not, however, raise his criticisms without suggesting a remedy. It is to the effect that a judge may call to his assistance any well-known professor of science not retained by the parties in dispute. The State should provide and the judge should appeal to the State for such assistance so that he might be aided in rendering a decision based upon scientific facts. By this method both the standing of the Bench and that of the professor would "gain in dignity and the pursuit of truth will again be considered one of the chief characteristics of a scientific life." Whether the method suggested by Prof. Trowbridge could be put in practice and would be effective even if adopted can only be determined by an actual trial. It is, however, well to call attention to these points, so that those who are tempted merely from a pecuniary standpoint to offer evidence on scientific questions, when such evidence would not be in entire accord with their best belief, may stop to consider the effective gain to be derived by so modifying their convictions as to make them harmonize with those of the contending counsel. It is not improbable that the day of the expert will soon be waning and that the costly litigations of the past will not be duplicated in the future.

Electricity in a Political Parade.

A novel idea will be incorporated in the political parade which is to be held in Chicago on Oct. 9. The managers of the Electrical Division of the parade have recommended that all manufacturers and dealers in electrical goods in that city close on that date in honor of the event. The electrical feature will consist of a special circuit along the line of march which will be connected with long-distance telephones for the purpose of transmitting by telephone the noise of the enthusiastic shouts of the paraders to various cities east and middle west. The plan is to place transmitters at the best vantage points with audiphones at the other ends of the lines so that people in other cities may hear the cheering and other audible expressions of enthusiasm from Chicago. A man will be placed at each transmitter to announce the name of each organization and number of division as the parade passes. The homes and headquarters of the prominent candidates will be connected with this unique circuit, so that they may hear some of the noises produced by the crowd. There will be many other novel features in the Electrical Division, and it is estimated that about 100,000 men will participate in the big parade.

Some Recent Röntgen-Ray Work.

BY ELIHU THOMSON.

Replying to your inquiry in regard to our experience with respect to the removal of hair and production of baldness by Röntgen rays, we have not in our working noticed anything of the kind, perhaps because the exposures have not been long enough. Neither have we noticed any particular tanning of the skin, perhaps for the same reason—that the improved tubes at our disposal enable us to produce radiographs in so short a time that no long exposures are required.

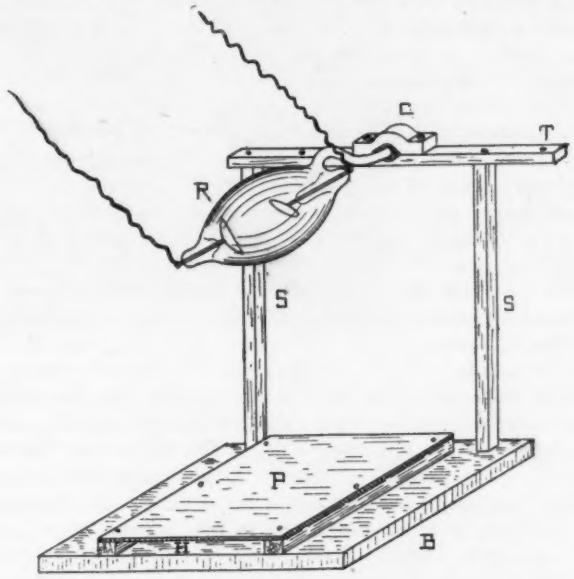


FIG. 1.

My own work has been specially directed toward perfecting apparatus required for energizing the tubes, and also the production of the best forms of tubes themselves. In pursuing this work we have been able to provide a small attachment to the tube which allows the vacuum to be raised or lowered until the best condition is obtained. so that a single Crookes tube may now last indefinitely. The General Electric Company has built, under my direction, high-potential high-frequency apparatus for alternating currents, especially suited to energizing Crookes tubes inductoriums or induction coils giving heavy sparks of from 3 to 12 inches in length and over, while a line of Holtz machines adapted to be run at high speed for large output have been made and are now on the market. I have also constructed for my own personal use a Holtz machine, having 24 revolving plates on a shaft, the plates being 12 inches in diameter, the whole machine being of extremely compact form. The output from this machine is very high, the sparks between terminals, when used without condensers, immediately setting fire to paper, while the effect in the Crookes tube is perfectly continuous. The electrical output of some of these Holtz machines is from 10 to 20 watts, as nearly as can be determined.

I have lately been giving some further attention to taking stereoscopic radiographs of the bones in the human system, and shall pursue this work further as my time permits. I am convinced from the work hitherto accomplished that the stereoscopic method of taking shadow pictures will be of the greatest possible value in allowing the actual parts to be seen in their proper relations. Take, for example, an ordinary Röntgen picture of the elbow joint. This shows the end of the humerus and the bones of the radius and ulna of the forearm all in one plane, and it is difficult to disentangle the various outlines, but when a pair of stereoscopic pictures is made and properly mounted the bones stand out in high relief and are seen in their proper relation; the various surfaces curve around in their natural way, and the bones themselves being semi-transparent to the rays, do not hide the outlines which are in their shadow. They are indeed like rods of partially transparent glass, so that the markings on the bones both on the upper and under surfaces are seen in their correct positions. In the same way anything of the nature of a diseased joint will at once be shown. To make such a pair of pictures is very simple. For this purpose I have used the arrangement shown in Fig. 1, which consists of a wooden base board *B*, supporting a

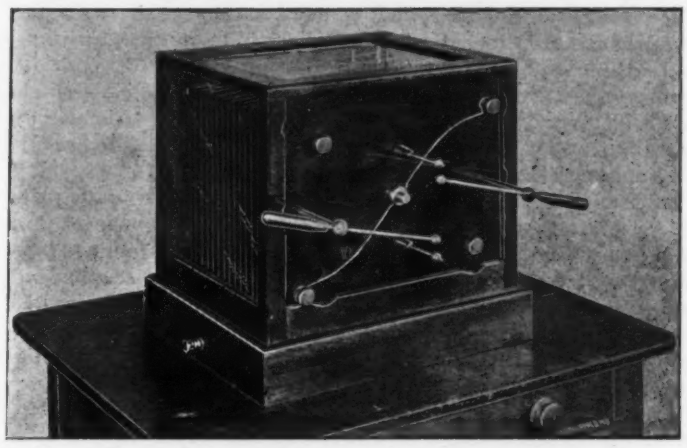
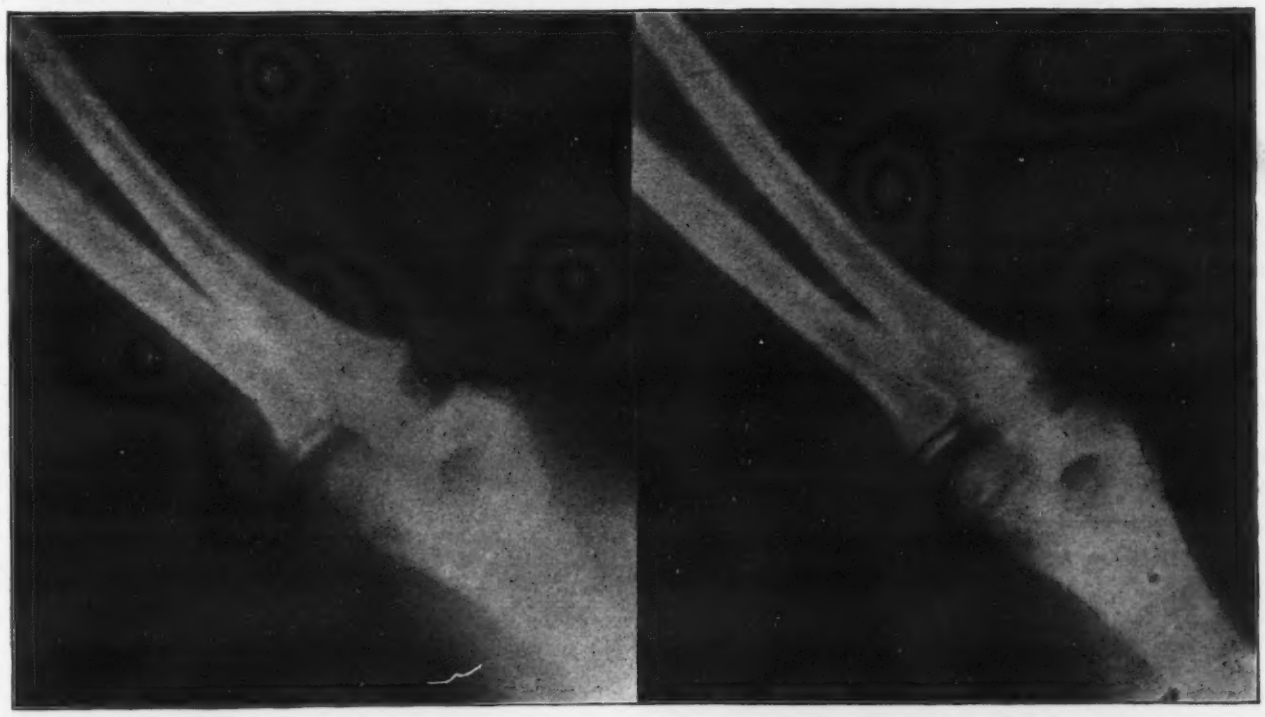


FIG. 2.



STEREOSCOPIC RADIOGRAPH.

ELBOW JOINT—FROM ABOVE. BOY TEN YEARS OF AGE.

thin wooden platform *P*, upon which the object of which a shadow picture is to be made is rested. Under the platform *P* is a space *H* for a plate-holder containing a sensitive plate. The upright pillars, *S S*, serve to support a cross-piece *T*, to which is clamped by a clamp *C* the tubular extension from the ray tube or Crookes tube *R*. The pillars *S S* have pins which pass up through openings in the cross-piece *T*, there being two sets of openings which permit the cross-piece *T* to be given two positions relatively to the object on the platform *P*. By simply lifting *T* off the pins and inserting the pins in the two other openings in *T* this shifting is made. Assume, then, that an elbow joint rests on the platform *P* and the plate holder has been inserted in the space *H*, under the platform *P*, the tube *R* is excited in one of its two positions for about three minutes to obtain an impression on the plate. Now, without changing the position of the object in the least, the plate-holder in *H* is removed and a new one inserted, with the new plate and the Crookes tube *R* is changed in position, by lifting the cross-piece *T* and setting it on the pins in its other position. Another equivalent exposure is made on the second plate. A single plate holder may be used, provided the two plates are separated by a lead diaphragm between them where they come back to back, it being only necessary in that case to reverse the plate holder, but it is safer on account of diffusion of rays to have separate plate holders. The two impressions when developed may be printed in the ordinary way, and the prints obtained therefrom examined by a a stereoscope show the parts of the object in proper relief, provided the displacement of the tube *R* has been such as represents the displacement of the two eyes in viewing the object. For example, if the object be 12 inches away from the tube *R*, a displacement of the latter, between each exposure of about two inches will give high relief to the prints, but a less displacement is generally sufficient. Any one who has examined pictures taken in this way will see at once the value of the method over the ordinary plane or too dimensional picture.

Railroad Telegraphers on Strike.

The telegraph operators on the Canadian Pacific Railway went on a strike on Sept. 28. Mr. Pierson, of the Order of Railroad Telegraphers, who ordered the strike, states that he was compelled to do so against his will. The cause of the trouble is stated to be poor pay, and efforts to bring about a more equitable and uniform rate of wages failed because of the alleged refusal of the railway officials to listen to the men's grievances. The train despatchers also joined the operators, resulting in serious trouble for the company in running its trains. It is stated that many of the men remain loyal to the company and new operators are being put to work, but in the case of the latter the difficulty lies in their inexperience with railroad work. It is reported that all of the train despatchers over the company's system have gone out. A later dispatch from the company's headquarters stated that the strike was practically over, and that only a few men went out. All trains are running on schedule time.

The Dominion Government has asked the Canadian Pacific Company for a statement of its case, to which Vice-President Shaugnessy has replied, saying that there is no question involved except whether the executive officers of the company shall ignore its rules and deal directly with an operator at Calgary without regard to General Superintendent Whyte of that division, or with an operator at Ashcroft, B. C., without reference to General Superintendent Abbott. Such action on the part of the management as the men demand, Mr. Shaugnessy says, would destroy everything in the nature of discipline.

Decision Against Drawbaugh.

The Court of Appeals of the District of Columbia, Washington, D. C., on Sept. 29 rendered a decision in the case of Daniel Drawbaugh, who was unable to obtain patents for certain alleged new improvements in telephone transmitters. The decision affirms the decree of the Commissioner of Patents, and holds that Mr. Drawbaugh was not the inventor of the transmitter in question. This case was divided into two parts and argued before the court last November, but the decision was withheld because Mr. Drawbaugh applied to Congress for relief. This application was withdrawn by Mr. Drawbaugh, whose petitions for patents were filed in 1883 and 1884. The decision was rendered by Chief Justice Aldey.

Meeting of the National Society of Electro-Therapeutists.

The National Society of Electro-Therapeutists held its fourth annual meeting at the Berkeley Lyceum, on Tuesday and Wednesday, Sept. 29 and 30. The meeting was considered most successful. A large number of papers were presented, and the doctors fully discussed their successes as well as their shortcomings. The engineer who is very prone to look upon the physician's conception of electricity almost sarcastically, would have been pleasantly surprised to find with what care and forethought the real electro-therapeutist handles his patients.

The president's address on "The Electro-Therapeutist as a Specialist," was practically a review of the development of electro-therapy as a science. He dwelled on the necessity of specializing and spoke very hopefully of the co-operation with the general practitioner.

"The Treatment of Old Paralysis," by Dr. F. M. Frazer, the next paper presented, was a statement of an interesting experience, where the application of the Faradic current, judiciously applied, served to stimulate the diseased organs to such an extent that the patient again obtained control over his muscles, which had been practically useless for a number of years.

Probably the most valuable of all the papers, and certainly the most interesting to our readers, was that by Dr. William Harvey King on the "Development of the Higher Vocal Register by Electricity." The author, after briefly reviewing the physics of the vocal chord, explained how the Faradic current may be made to stimulate the vocal chord without tiring the singer's chest or lungs. By applying the shock to the vocal chord, the reaction of the same will make it elastic, just as the muscles in the arm may become elastic by proper exercise. With increased elasticity, the speaker explained, the vocal chord may be made to produce the proper notes.

Messrs. Ralph W. Pope and Townsend Wolcott presented a paper on alternating currents and transformers, the only engineering paper presented to the convention. A popular review of the methods of electric lighting and power was given and in the discussion, which was participated in by Lieut. Jarvis Patten and Mr. Max Osterberg, the question of the motor-dynamo was brought up, its use urged upon the physicians and it was not a difficult matter to convince almost all the physicians present of the value of this device.

Dr. F. A. Gardner, of Washington, D. C., was elected president for the ensuing year. Dr. William R. King, also of Washington, was appointed secretary. Next year's meeting is to be held in Washington.

New Underground Railway in New York.

The Central Tunnel Railway Company, the New York & New Jersey Tunnel Railway Company and the Terminal Underground Railway Company of New York, were consolidated on Oct. 2, the combination taking the name of the Underground Railway Company of the City of New York. The company proposes to construct underground railways under the streets of New York City, to be about five miles in length. The proposed route will start from City Hall Park, run northerly under Chambers Street, Reade, Elm, Spring, Marion and Mulberry Streets, and on to the Grand Central Station at Forty-second Street, connecting with the Fourth Avenue improvement. Three branches are to be constructed, one from the Thirty-fourth Street ferry on the East River, connecting with the main line at or near Thirty-third Street; another at City Hall Park running easterly to the East River, terminating at or near South Ferry, and the third branch from the City Hall Park running westerly and terminating at or near South Ferry. The capital of the new company is $5,000,000, and the incorporators are: President, Bernard F. O'Connor; vice-president, Cornelius V. Sidell, of New York City; treasurer, Charles C. Wast, of Ridgewood, N. J.; secretary, James M. Fisk, of Newark, N. J.; directors, G. A. Liebig, Arthur M. Hatch, of Brooklyn; Spencer D. Schuyler, William C Nicoll and Raymond L. Ward, of New York City.

Queen Victoria's Long Reign.

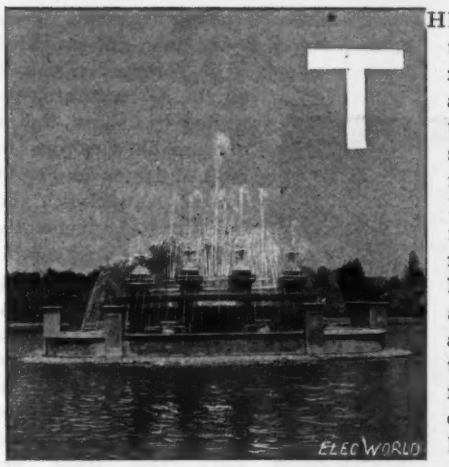
The 60 years of the reign of Queen Victoria, which will be completed in June, 1897, constitute without doubt the most brilliant period of the history of mankind, as far as progress is concerned. In this time have been produced the railway, the telegraph, the steamships, and most all of the great agencies employed in the arts and industries of the world. The record is a brilliant one, and at the head of the list stands ELECTRICITY!

Willow Grove Park and Electric Road.—II.

BY HERMANN S. HERING.

(*Continued from page 389.*)

XII.—THE ELECTRIC FOUNTAIN.



THE most interesting electrical feature and the most popular attraction at Willow Grove Park is the electric fountain, situated in the large lake near the Casino and Music Pavilion. The fountain structure, measuring 50 feet across, has two basins, one five and the other eight feet above the lake. It contains 38 nozzles, varying from ⅝ to 1½ inches in diameter and eight hundred and sixty-seven ⅛ and ¼ inch jets, arranged to throw vertical and inclined columns and sprays, in large and small circles and arcs, permitting a large number of beautiful combinations to be made, which when illuminated by the powerful electric lights, produce iridescent effects of wonderful beauty.

The electric fountains at the World's Fair, though larger and grander in some respects, were not in themselves more beautiful nor more successful than this one at Willow Grove Park. In fact, there are several original and unique features contained in this fountain that are a decided improvement over any electric fountains heretofore constructed.

The electric fountain at Washington Park near Philadelphia has as its main attractive feature the live statuary displayed in the centre behind a veil of water, all being beautifully illuminated by arc lights.

The electric fountain at Schenley Park, Pittsburg, is somewhat similar to the one at Willow Grove Park, but has only one basin.

The Willow Grove fountain, as well as the one at Pittsburg, was designed by Mr. F. W. Darlington of Philadelphia, the engineer who planned and designed practically the entire electric railway system of the Philadelphia Traction Company, including power stations and line equipment, a most potent evidence of his engineering ability.

The fountain is located in a conspicuous position, conveniently visible to an audience of many thousands. It is operated for about an hour in the afternoon and for 15 minutes three times in the evening.

Twelve sets of jets and nozzles are supplied by independent pipes controlled in the operating room on shore, by means of lever-valves, thus obtaining a large number of combinations by means of any of these sets with various amounts of water. These 12 pipes are connected to a main, and this directly to an electrically driven pump, whose speed can be varied to produce different pressures.

FIG. 11.—NIGHT VIEW OF ELECTRIC FOUNTAIN SHOWING "WHEAT SHEAVES."

The electrical illumination is obtained by means of powerful electric lights beneath the fountain, arranged to throw vertical beams of light in the path of the streams of water. The colors are produced by means of color screens placed between the lamp and the plate-glass covered funnels in the ceiling of the fountain basement. The color screens are controlled by means of independent hand wheels located at a common point and varied by an operator, who is thus enabled to obtain any desired combination.

Fig. 17 shows a preliminary sketch of the fountain structure, the cut being kindly loaned by Mr. Darlington. The operating house on the right, instead of being covered as shown, has a handsome observation pavilion built over it.

The initial letter presents a daylight view of the fountain, with four sets of jets and nozzles in use, and shows the general appearance of the fountain structure as completed.

XIII.—CONSTRUCTION.

The fountain basement is 44 feet inside, with foundations built of cut stone on concrete, and the walls of brickwork and stone 30 inches thick. The corners are rounded and give an octagonal effect. The superstructure is cement-work on expanded metal and brick. The roof is iron column and beam construction, and the floor heavily cemented, the whole structure built on a heavy bed of concrete.

The upper basin is five feet above the lower basin and 23½ feet across. The lower basin is three feet and the upper one eight feet above the surface of the water in the lake. The roof of the basement is eight feet high at the sides and 13 feet in the middle.

The funnels in the roof, through which the light passes, are cast-iron turrets 22 inches in diameter and 26 inches high, with plate-glass tops. There are eight in the lower and seven in the upper basin.

The fountain basement is connected with the operating rooms on the shore by means of a tunnel 3½ feet wide, 5 feet high and 90 feet long, having an arched roof. This tunnel is of brick and cement with a concrete base.

The pump and operating rooms form the basement of the circular lake pavilion. The pump-room is 25 feet in diameter and 14½ feet high, and the operating-room 15 feet square and 7½ feet high. Fig. 12 shows both rooms and also part of the entrance to the tunnel on the right. The walls are stone and cement.

The fountain itself is cement-covered brick-work, the vases being painted cast-iron. The pipes running along the bottom of each basin are endless, the main feeder and the branches to the nozzles and jetted pipes being connected to the circular pipes by T joints. The central nozzle and the "fan" have direct pipes. Fig. 16 shows the location of the nozzles and jetted pipes.

XIV.—PUMP-ROOM.

The pump-room shown in Fig. 13 contains two G. E.-2000 railway motors, 75 horse-power each, directly connected to one 9 x 12 Gould triplex pump, one motor being coupled to each end of a shaft which drives the crank shaft through a double reduction-gear. The pump has a normal capacity of 1000 gallons per minute, but can be forced to 1200 and 1500. The water pressure can be varied from 40 to 100 pounds, which will throw a stream 150 feet high.

The motors are operated by a series-parallel controller, the connections being the same as for railway purposes. The power required by the varying pressure and quantity of water used in a display fountain is very similar to the varying power required for traction work, and railway motors giving variable torque and speed are especially adapted for this kind of work. The operator handles the controller in addition to the water valves.

The pumping is direct and the main is provided with a small air-chamber and relief valves for protection against water hammer.

XV.—OPERATING ROOM.

This room, shown in the rear in Fig. 12, contains the electric switches and fountain valves, and an outlook on the fountain for the operator. The floor is considerably above the floor of the pump-room, to enable the operator to see the fountain. A marble switchboard on the left contains switches controlling the circuits of the fountain lights, the incandescent circuits in the operating room, tunnel and fountain basement, and those around the lake and in the lake pavilion. The lamps in the vicinity of the fountain are not run during the fountain exhibitions in order to enhance the effect. The necessary ammeters and hydraulic pressure gauges are also conveniently located.

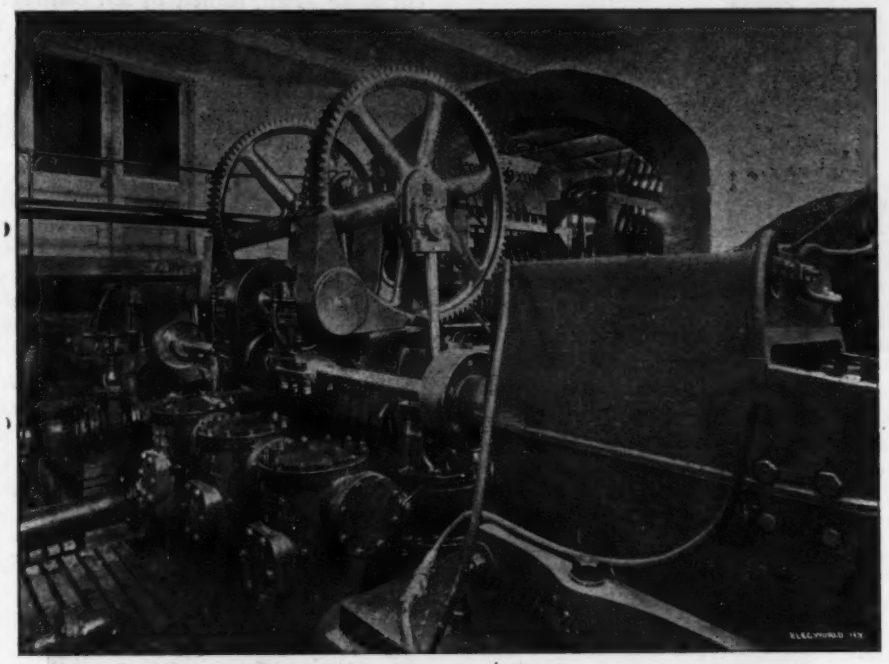


Fig. 12.—Operating Rooms of Electric Fountain.

The fountain valves are quick-opening lever valves, with 3½ foot levers, each having 14 positions. The 12 pipes running to the fountain are connected to two sets of 12 valves each. These are duplicates, the manifolds being connected to the main through a two-way valve, by means of which either set can be used. One object of this arrangement is to enable the operator to set a fountain combination while one was playing and then merge one into the other smoothly and gradually by turning the two-way valve.

Through a contractor's mistake the proper kind of valve was not inserted, and only one set of valves is used at present, which prevents the best results from being obtained.

Ten of these 12 feeds are six-inch and two are three-inch pipes.

XVI—FOUNTAIN BASEMENT.

A view of the basement under the fountain is shown in Fig. 13. The outer low-ceiling portion is under the lower basin, and the inner high-ceiling part is under the upper basin.

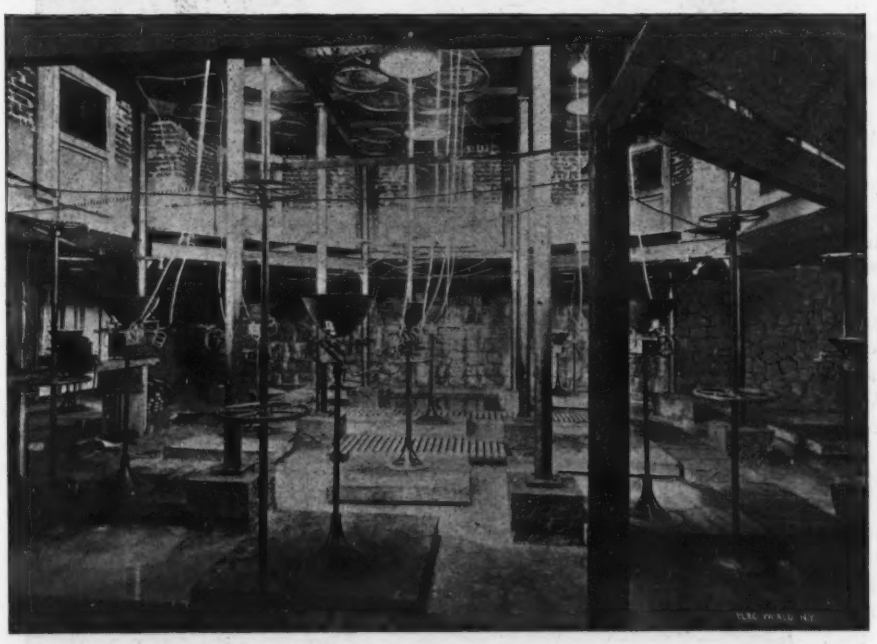


Fig. 13.—Fountain Basement.

There are eight light funnels in the outer ring, six in the inner ring, and one in the centre, making 15 in all.

One arc lamp, with parabolic reflection, is placed under each funnel. These lamps are vertical focusing lamps, 8000 candle-power, 40 amperes, using ¼-inch carbons. They were made by the Rushmore Dynamo Works, Jersey City, and are connected five in series on the 500 volt circuit, with resistance equivalent to the lamps, also in circuit. These lamps are placed on iron stands, the top of the reflector being about five feet above the ground. The lamps are about seven feet below the nozzles on the lower basin, and 12 feet on the upper basin.

The color screens are revolving discs, each having five colors. They are supported on vertical shafts pivoted on the floor, and provided with a hand wheel and a sprocket wheel. The sprocket wheels of all these shafts are connected by short chains and flexible wire ropes to a set of drums and hand wheels, enabling the operator to conveniently make any desired combinations. This operating rack is shown in Fig. 13, in the rear to the left, near the entrance to the tunnel. The colors in the discs are white, orange, purple, green and red. The discs are placed near the roof, and about three feet below the nozzles, and although from 5 to 10 feet above the lamps the heat has been great enough to crack the glass, which made it necessary to place wire netting close against the under side of the discs.

By means of an annunciator connected to the operating room, signals are given to the color operator concerning the combinations of nozzles and jets about to be made.

XVII.—NOZZLES AND JETTED PIPES.

The arrangement of nozzles and jetted pipes is shown in Fig. 16.

The outer ring in the lower basin contains one hundred ⅛-inch jets inclined to the centre, and when turned on full give a veil and spray effect as shown in the initial.

The eight small rings surrounding the light funnel in the lower basin each contain sixty-eight ⅛-inch jets inclined tangentially and slightly toward the centre, the ring-pipe being level. These give the "wheat sheaves" and "vases" according to the pressure of water, and are one of the most popular figures. They are shown in Fig. 11 in the lower basin.

In the centre of each of these small rings are two ¾-inch nozzles, one inclined to the centre of the fountain and one vertical, making 16 nozzles in all. The streams from the inclined nozzles in the lower basin can be seen in Fig. 14.

The set of vertical nozzles is not in use at present as it was intended for elaborate rotating nozzles. The eight iron vases each have a vertical ¾ inch nozzle. These streams are for daylight use, as they are not illuminated. The upper basin contains a large ring-pipe with fifty-eight ¼-inch vertical jets for daylight spray effects. Inside of the large ring-pipe are six small ring-pipes encircling the light funnels, having eleven ¼-inch vertical jets for bunched spray effects.

In the centre of each of these is a ⅝-inch nozzle for throwing

vertical streams. They are shown in Figs. 11 and 14 in the upper basin.

Placed between these small ring-pipes are six 1¼-inch nozzles for throwing high vertical streams. Ordinarily they reach 90 ft., but they can be forced above 100. Although these nozzles are not directly over the light funnels, the streams are illuminated by the stray light and by their practically coinciding with the beams of light some distance up.

In the centre of the fountain is a small ring pipe en circling the light funnel, containing eleven ¼-inch vertical jets for spray effects, and a 1½ inch vertical nozzle which, with full pressure, can throw a stream 150 feet high.

The two arched pipes in the upper basin have eighty-eight ⅛-inch jets slightly inclined toward the centre and give a large fan effect about 80 feet across and 40 feet high. The streams meet and break near the edges, giving the fountain a beautiful feathery appearance. This is one of the novelties and the most popular figure with the spectators, especially at night. A daylight view of the fountain, showing a "fan" effectis given in Fig. 15.

FIG. 14.—NIGHT VIEW OF ELECTRIC FOUNTAIN, SHOWING PYRAMID.

The night views of the fountain were taken by five-minute exposures and were kindly loaned by Mr. Darlington.

XVIII.—COMBINATIONS.

These 867 jets and 37 nozzles, arranged in 12 independent sets, each capable of variation in the quantity of water used, permit of a very large number of combinations. When these are used with the various colors the variety of combinations is greatly increased. Those shown in Figs. 11, 14 and 15 are among the most popular, but merely indicate the possibilities.

The use of assorted colors with ever changing combinations is very beautiful, and especially when the color disc is rotated rapidly, producing a sparkling iridescent effect. This is one of the new features of this fountain.

Another one is produced by alternately opening and partly closing some of the valves, thus causing the streams and sprays to vary in height and break in upon each other, producing novel and beautiful kinetic effects.

Doubtless in the near future rotating nozzles, spiral columns and waving sprays will be introduced in electric fountains, as illuminated moving streams must be very beautiful.

The author desires to express his obligations to the following gentlemen:

General Manager Beetem and the members of the engineering staff of the Union Traction Company, through whose courtesy and assistance the description of Willow Grove Park and Electric Road was made possible.

Mr. McClelland Herst, the superintendent of the Park to whose marked executive ability the successful management of the Park

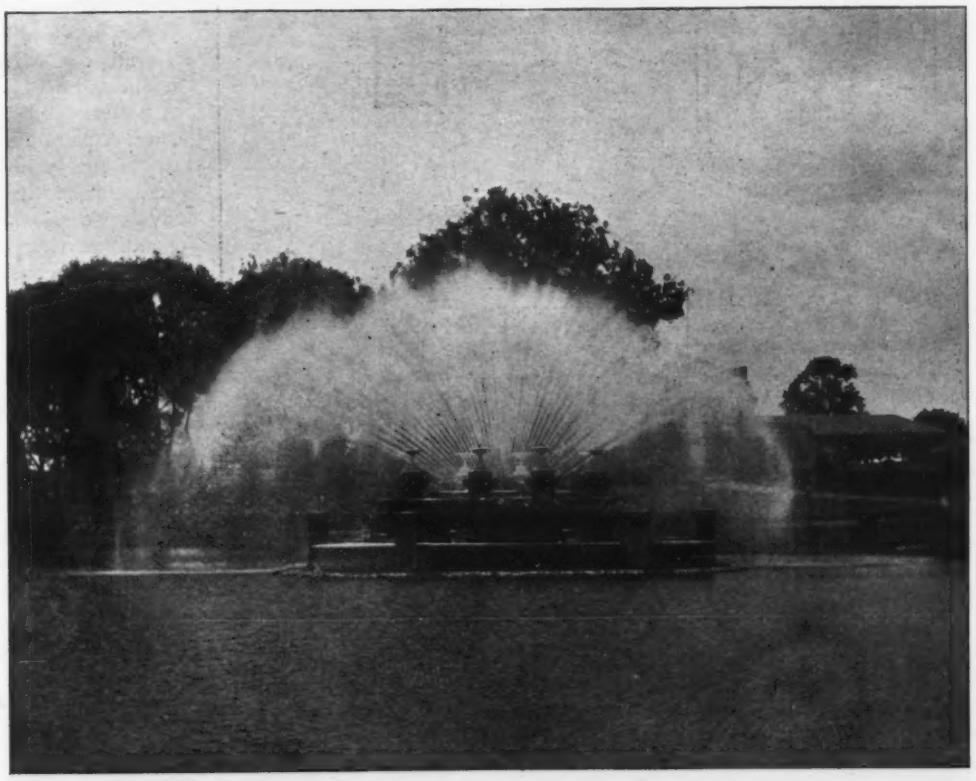


FIG. 15.—DAYLIGHT VIEW OF ELECTRIC FOUNTAIN SHOWING THE "FAN" EFFECT.

is due, for facilities in obtaining photographs and data. Mr. F. W. Darlington, the designer of the electric fountain, who kindly furnished much of the data and loaned some of the illustrations concerning it.[1]

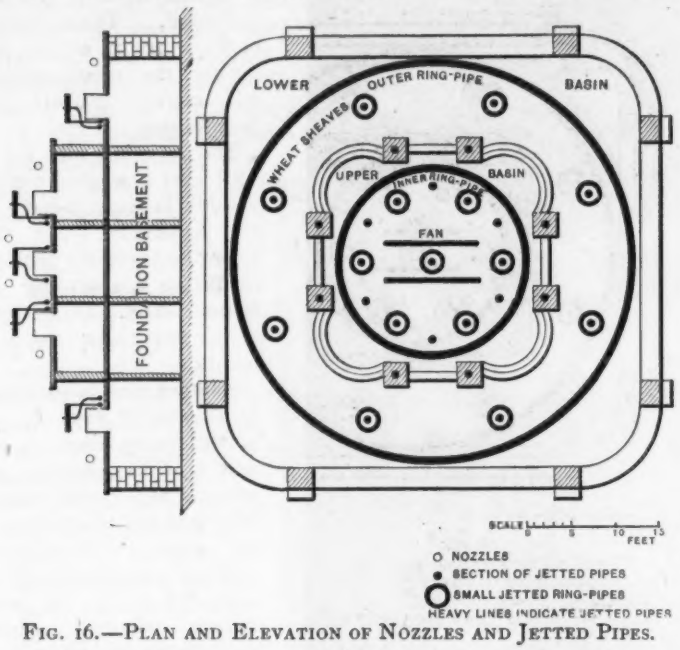


Fig. 16.—Plan and Elevation of Nozzles and Jetted Pipes.

Mr. Geo. W. Simpson, the electrician of the Park, through whose co-operation the successful photographs of the fountain and much electrical data about the Park were obtained.

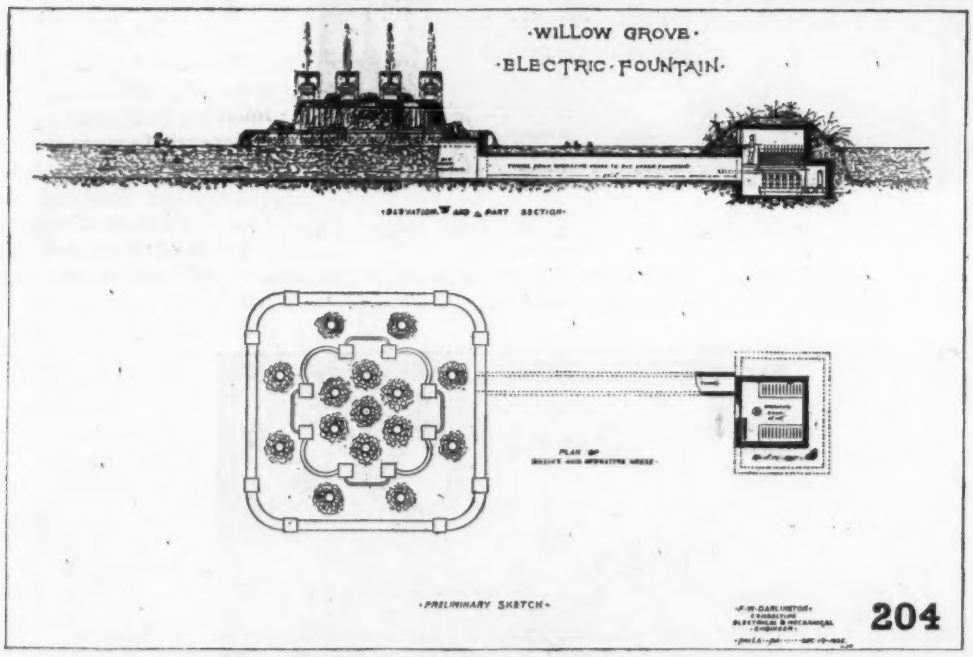


Fig. 17.—Preliminary Sketch of Electric Fountain.

Mr. Chester E. Albright, the able engineer of Messrs. Wendel & Smith, the designers and builders of the Park, to whom the engineering design and the rapid and successful construction are due, and Mr Charles Mebus, Mr. Albright's assistant, who supervised the mechanical equipment, including the fountain, for sundry courtesies.

Electric Meters.

To the Editors of The Electrical World.

Sirs:—I have read Mr. Haskins' defense of the Thomson recording wattmeter and would state that all electric meters in Canada are inspected and sealed by the Government and remain sealed for six years, when they are again tested.

This, you must admit, changes the matter considerably, and I am sure that when Mr. Haskins makes some experiments with these meters which have been sealed up for any length of time, the results will not be so accurate as those obtained from the experiment he describes.

James Milne.

Toronto, Can.

[1] Figs. 11, 14, 15 and 17 were kindly loaned by Mr. F. W. Darlington.

To Enjoin Cable Laying.

On Oct. 1 was filed in the office of the Clerk of the United States Circuit Court, in New York City, a bill of complaint in a suit brought by the United States against La Compagnie Française des Cables Télégraphiques, the United States & Haiti Telegraph & Cable Company and the United States & Haiti Cable Company. The complaint alleges that the defendant companies are combining and conspiring together for the purpose of monopolizing a part of the trade and commerce between the United States and the several States thereof and foreign nations, to the irreparable injury of the people and business interests of this country. An injunction is asked to prevent the defendants from carrying out their alleged unlawful agreement and from establishing their connecting cables on the shores of the United States. The complaint sets forth these facts in the case:

La Compagnie Française des Cables Télégraphiques was organized under laws of France on July 2, 1895, and entered into an agreement with the French Government on Dec. 29, 1895, to operate within two years a cable connecting without intermediaries the cables traversing the Caribbean Sea with the transatlantic line. It also agreed to lay a new cable line from Brest to a landing near Cape Cod, Mass. The French Government agreed to pay the cable company an annual subsidy of 800,000 francs during a period of 30 years. The cable company and its predecessors had been endeavoring for years to land a cable on the shores of the United States, but they could not obtain the permission of the United States Government, except on condition that the French company should surrender its cable monopoly between the United States and the islands and South American countries.

For the purpose of evading this obstacle, it is charged in the bill of complaint, La Compagnie Française des Cables Télégraphiques entered into an unlawful agreement with the other defendant companies to secure direct communication between the United States and the West Indies and South American system of cables.

The United States & Haiti Cable Company was organized on Feb. 4, 1895, under the laws of West Virginia, with a capital of $10,000, its incorporators being John W. Mackay, George G. Ward, Albert Beck, John W. Mackay, Jr., and Albert B. Chandler. This company, it is charged, was organized in the interest of the French company, for the purpose of laying a few miles of cable from Coney Island out to sea, which could then be connected with the West Indies and South American cable system. By this scheme La Compagnie Française des Cables Télégraphiques would escape the conditions and maintain its monopolistic and exclusive concessions from West Indian and South American countries, at the same time fulfilling its contract with the French Government and earning the large subsidy.

Ten miles of cable were laid from Coney Island about July 9, 1895, and then the United States & Haiti Telegraph & Cable Company was organized under the laws of the State of New York, the nominal capital being $1,800,000, and the incorporators, Albert B. Chandler, Albert Beck, John Beattie, Edward C. Platt, John W. Mackay and George Clapperton. The purpose of this company was to build a telegraph line from New York City to Coney Island, and connect there with a cable to Haiti. The United States & Haiti Telegraph & Cable Company, it is alleged, is the successor of the United States & Haiti Cable Company, is controlled by the same interests, and has for its purpose to assist the French cable company to achieve its unlawful objects.

The combination of these companies, it is charged, was consummated in view of a bill which has been before the United States Senate since May 27, 1896, entitled, "An act regulating the establishment of submarine telegraphic lines or systems in the United States," the passage of which would defeat the French cable company's efforts to secure a landing in the United States.

The French company has chartered two ships to carry the work to completion, and it is asked that an injunction be speedily granted.

Electrical Machinery of the Walker Company.

THE higher efficiency, the greater output per unit of weight, the increased economy, both in production and operation, and the relatively small floor space required by large units are among the conditions which have necessitated the introduction of the present methods in the construction of heavy electrical machinery. So radical are the changes thus brought about, and so rapid have these changes been made, that it is only by a periodic study of the practice of large manufacturing companies that an idea may be obtained of this most important and extensive development. It is, therefore, the purpose of the present article to set forth in as brief and concise manner as possible the practice of one of America's largest and most prosperous manufacturing concerns.

The Walker Company was organized on the 26th of May of this year, with a capital of $2,500,000. It is the outgrowth of the Walker Manufacturing Company, organized in 1883 for the purpose of manufacturing cable machinery. The company, however, gradually realizing that the usefulness of the cable was rapidly being curtailed by the increased growth of electric railroading, in 1893 determined to enter upon the manufacture of dynamos and motors for railway and lighting purposes. It had previously constructed a shop for the manufacture of heavy machinery, the facilities of which are unrivaled, and with its able engineers it was in a position to guarantee the excellence of the product which it was about to place on the market. The results have been exceedingly gratifying, for the cable machinery, so rapidly found favor in connection with electric equipments that the enormous facilities of the Walker Manufacturing Company were overtaxed. Reorganization and enlargement became a necessity, with the result that the Walker Company was formed, which bought the entire plant and equipment of its predecessor. An additional factory has been secured at New Haven, Conn., while the principal factory, located at Cleveland, O., is to be extensively enlarged, the company owning tracts of land adjacent to the latter, which will give it all the room that could be desired.

The present Cleveland factory covers 10 acres of ground, is located on Waverly Avenue, adjoining the lake shore, and is devoted almost exclusively to the manufacture of dynamos and motors.

Fig. 1 represents a general view of one of the numerous bays of the machine shop and shows how cramped are the present facilities. Each of the parts lying on the floor in such apparent confusion is in the process of construction, and during working hours is surrounded by numerous machinists. As soon as the material is finished, it is hurried to the stock room or more often shipped directly, only to be replaced by other work. The company possesses massive machine tools, of which one, a large planer, capable of carrying complete an 800-kw generator, is illustrated in Fig. 2. The piece now upon it, as shown in the illustration, is the base frame of a large generator adapted for direct-connection. In Fig. 4 is shown a large boring mill, which can handle the largest armatures the Walker Company turns out, while Fig. 3 represents a general view of the foundry.

The Walker Company manufactures street railway generators

FIG. 1.—ARMATURE DEPARTMENT. FIG. 2.—LARGE PLANER.
FIG. 3.—FOUNDRY DEPARTMENT. FIG. 4.—BORING MILL.

Walker Company has actually built and sold no less than 22 different sizes and types of railway and lighting generators, and five sizes of railway motors, a sixth being now in the course of construction.

The name "Walker," prominent in the manufacture of excellent controllers and other accessories and direct-current lighting apparatus, and will enter shortly into other fields. In this it claims to be the only independent large manufacturer of such apparatus, and it positively denies all assertions of having commercial relations with any other company.

The railway generators which are of the multipolar type vary from six poles in the smaller sizes to 14 poles in the 1600-kw machines. From a general view of the Walker generator, which may be seen in Fig. 5, it will be noted that all the parts are liberal in their dimensions, simple, massive and powerful. The field magnet is of cast iron, while the pole-pieces are of wrought iron. Cast iron is used because the Walker Company regards it as superior to steel in regulating qualities; also the necessarily larger area in the cross-section of the yoke gives it greater strength and rigidity. The pole-pieces are formed of laminated iron plates assembled together and cast into the yoke piece. The end plates are considerably thicker than the inner ones in order to give a rigid backing and a means of support. The ends of the pole-pieces are dove-tailed to a depth sufficient to make the area of contact between the plates twice the section of the magnet waist, so as to prevent an undue crowding of the magnetic flux. The plates are slotted in the middle as shown in Fig. 6, thereby making a deep groove in the finished pole piece, the object of which is to prevent an excessive distortion of the field and make the distribution over the pole-pieces more uniform. The concentration of the lines will, therefore, be in two places, at the pole tip and at the edge of the slot farthest from it. This prevents the moving of the non-sparking position with change of load, thereby minimizing the amount of attention to the brushes required by the attendants.

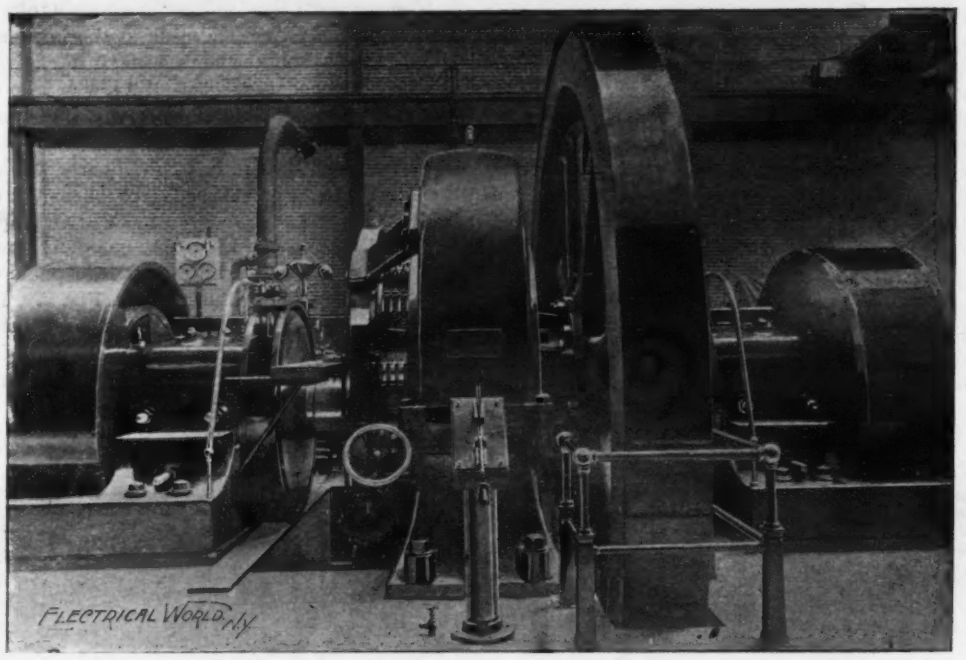


Fig. 5.—Direct-Connected Generator.

The poles are assembled in a cast-iron frame such as is shown in Fig. 7. They are thus rigidly held in position and the iron readily cast about them. The pole-pieces are surrounded by a soft rectangular steel frame, which forms a pole-shoe and distributes the magnetic induction over the armature. After the shoes are fitted in place, the whole field magnet is finished by machine tools. The pole-shoe, besides distributing the flux and reducing the magnetic reluctance, also serves to support the field-winding. In Fig. 7, which is a general view of the field-magnet, it will be seen that there are only two magnetic joints. These are planed and screwed together with great care. This figure also illustrates the method of supporting the brushes. The support is a continuous ring of iron surrounding the middle of the commutator, and held in its position by four arms projecting from the field-magnet at points of equal magnetic potential. There is, therefore, no magnetic leakage across this iron ring. The edges of the ring are suitably faced to slide in the arms, while its angular position is varied by a long suitably-threaded spindle passing through a nut mounted on the side and turned by a hand-worm. This brush-holder construction is employed on all types of direct-connected units, and is extremely convenient, because it leaves the commutator free, and also because it permits of removing the outboard bearings without taking off the brushes. The two pedestals cast on the lower half of the field magnet serve to support it. On some machines these pedestals are arranged to slide in grooves, so that the whole field magnet may be removed sidewise from the armature, thus leaving both field and armature coils completely accessible. The field spool consists primarily of a rectangular galvanized iron tube adapted to fit easily over the pole-pieces. These spools are made with skeleton brass collars, which are amply strong to support the wire wound upon them, and are suitably ribbed to attain the strength with the least amount of metal.

The insulation of the spools is done entirely by boys. Fuller board and mica are not spared to render the insulation as perfect as possible.

Fig. 6.—Pole Piece Plates.

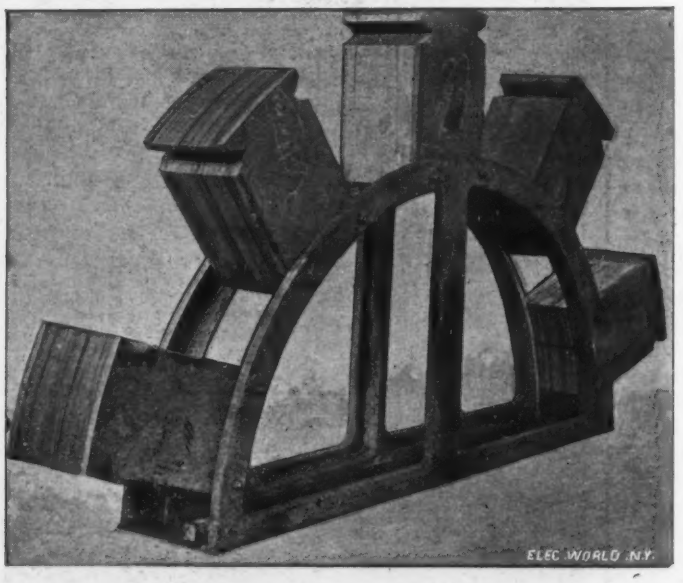


Fig. 7.—Assembled Pole-Pieces.

The end collars are fastened with thick pieces of fibre, and there is also a fibre division between the shunt and series coils.

In winding the spools are placed on a slotted block and revolved in a special form of lathe, a general view of which is presented in Fig. 11. This lathe has two speeds, either of which may be used by throwing a

shipper in the required direction. The shunt-coil is wound after the ordinary manner, while the terminals are flat pieces of copper suitably arranged for convenience in connection. The series-coil, however, is wound somewhat differently from the regular process and indicates a decided advancement. A number of flat ribbons of sheet copper, each the exact width of the compartment for the

FIG. 8.—CORE AND PUNCHINGS.

series-coil, is wound upon the spool, so that there is but one turn per layer. Because of the thinness of the ribbon, the number of layers may be made sufficiently great to make up the required number of turns. This method produces a flat, dense coil that could not possibly be obtained by using round wire, and it is, moreover, very much more easy to wind. The ribbons are wound on together, each from a separate reel, and are taped with adhesive tape as the winding progresses. Inasmuch as the difference of potential in the various parts of the series-coil is very low, a $\frac{1}{16}$-inch combination

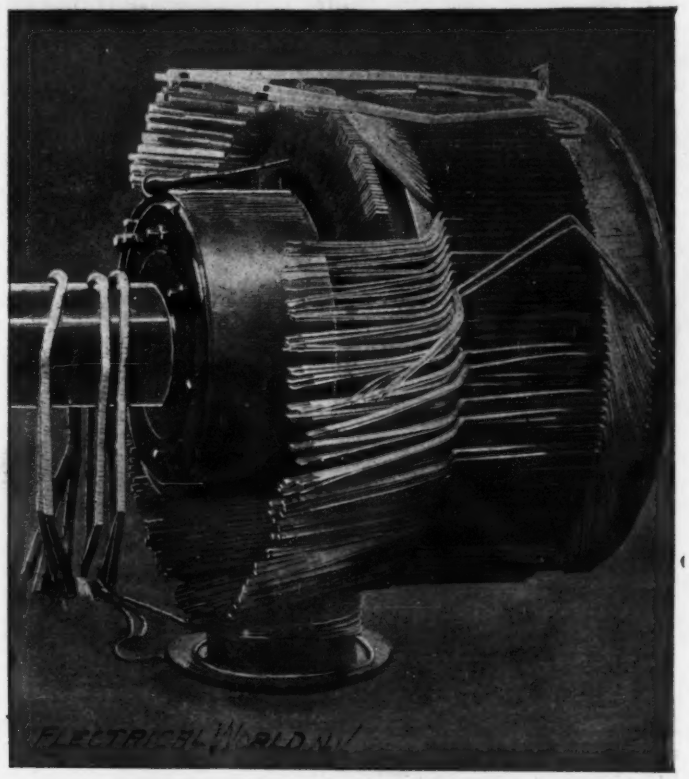


FIG. 10.—PROCESS OF ARMATURE WINDING.

insulation between the layers is all that is required. After both shunt and series-coils have been wound on, they are covered with cloth upon which a rope-winding is placed when the coil is complete and ready to be slipped over the pole-piece.

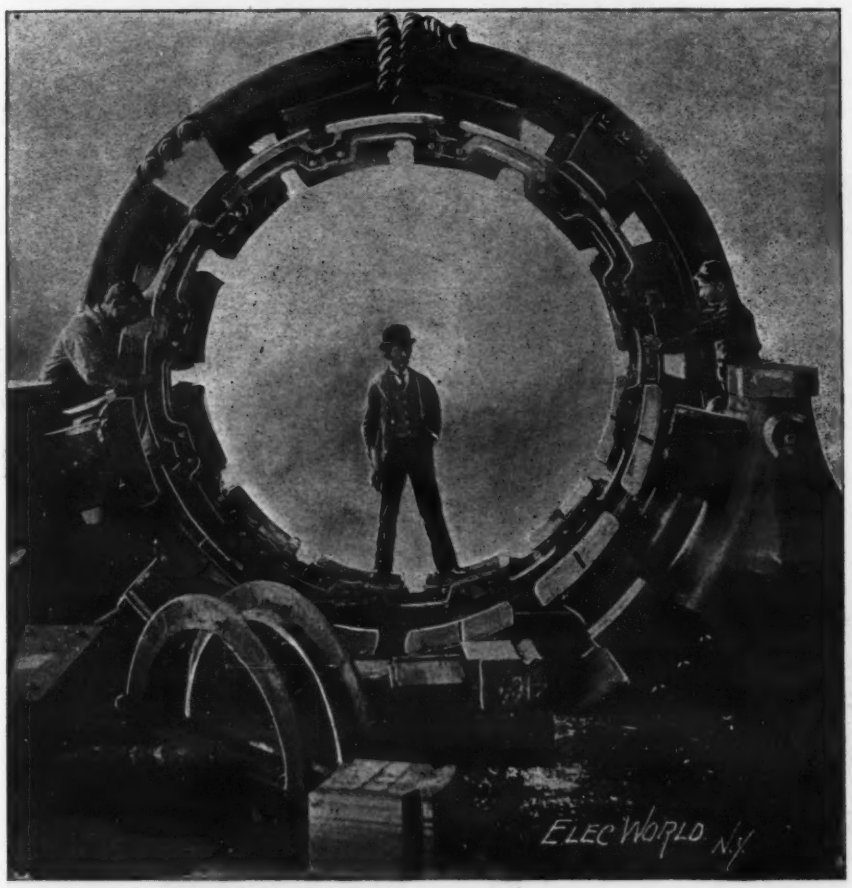


FIG. 9.—GENERAL VIEW OF FIELD MAGNET.

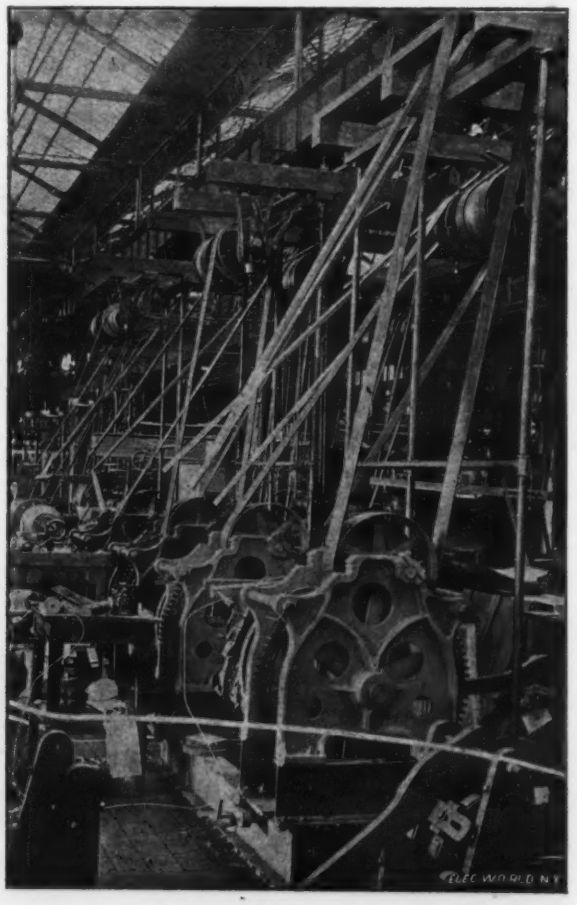


FIG. 11.—WINDING LATHES.

The armature manufactured by the Walker Company is no less

carefully made. The core is built up of punchings with straight teeth on the outer curved surfaces and dove-tailed projections on the inner. These projections fit in slots planed in the arms of the cast-iron spider which is merely keyed to the steel shaft. An excellent

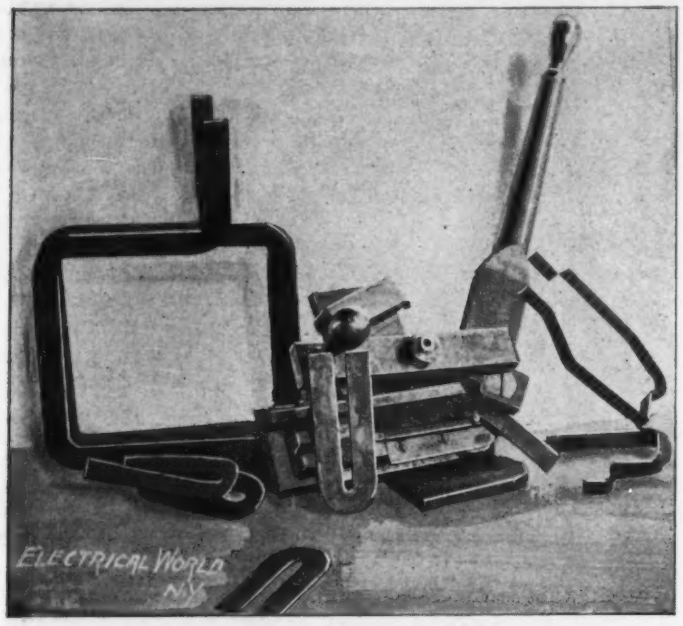


Fig. 12.—Machine for Bending Flat Coils.

idea of the construction of the core and the shape of the punching may be obtained from Fig. 8. A punching is made in two dies; the first strikes out the whole punching with the exception of the teeth, and the second stamps the teeth four at a time. The punchings are arranged with the edges staggered, thereby giving the armature a much greater mechanical strength. The spider, it will be noted, instead of being a continuous ring in its outer periphery, is simply a series of arms with T-shaped ends carrying dove-tailed grooves. Spacers are placed at intervals between the punchings. These spacers leave air spaces running from the centre of the armature to its outer surface, which serve for ventilation. The punchings are held in place by two massive cast-iron end discs, the general shape of which is also shown in Fig. 8. These discs perform the double function of supporting the punchings and connectors for the arma-

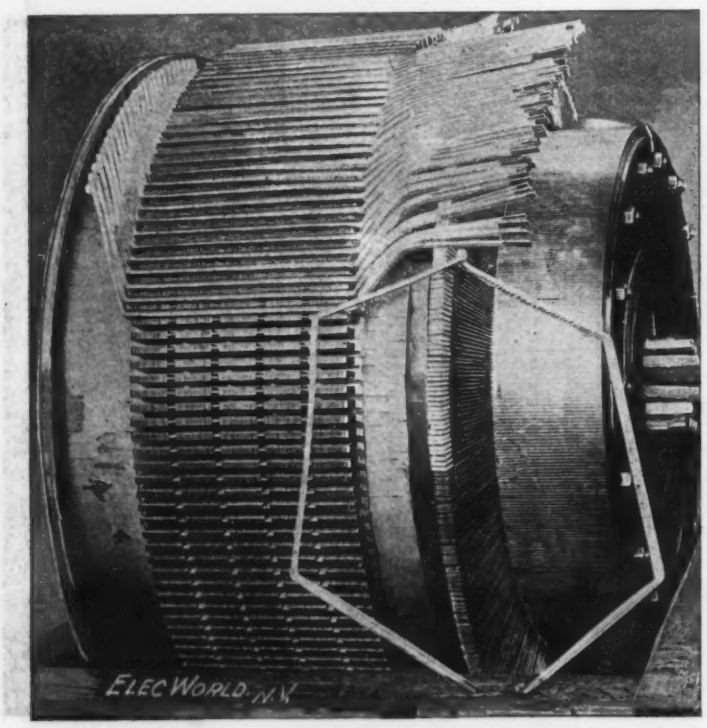


Fig. 13.—Large Armature Winding.

ture coils. A large flange protects the armature coils from mechanical damage and from oil and grease from the shaft. The insulation of the armature conductors may be seen in Fig. 13. A trough is inserted in the armature slots, consisting of several thicknesses of fuller board and mica. In this trough the conductors which are heavily taped are placed. The coils are separated in the slots from each other by composite strips, and the conductors forming them are separated by

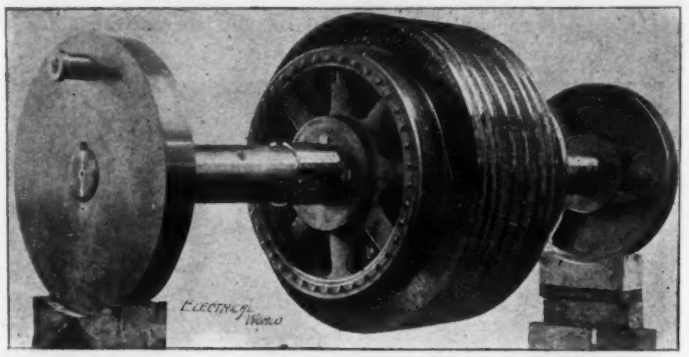


Fig. 14.—Direct-Connected Armature.

strips of fuller board. The tape used is adhesive on one side and dry on the other and therefore while it adheres tightly to the coils the coils do not stick but slip into place with the greatest facility. Figs. 10 and 13 show armatures in the process of winding. The two shown are lap windings as will be readily noted by the shape of the coil. Each slot carries a number of conductors taped together and forming one coil. The coil lead is arranged to suit the convenience of the brush holder of the type of machine for which it is built. The space between the outer and inner connections is always filled with

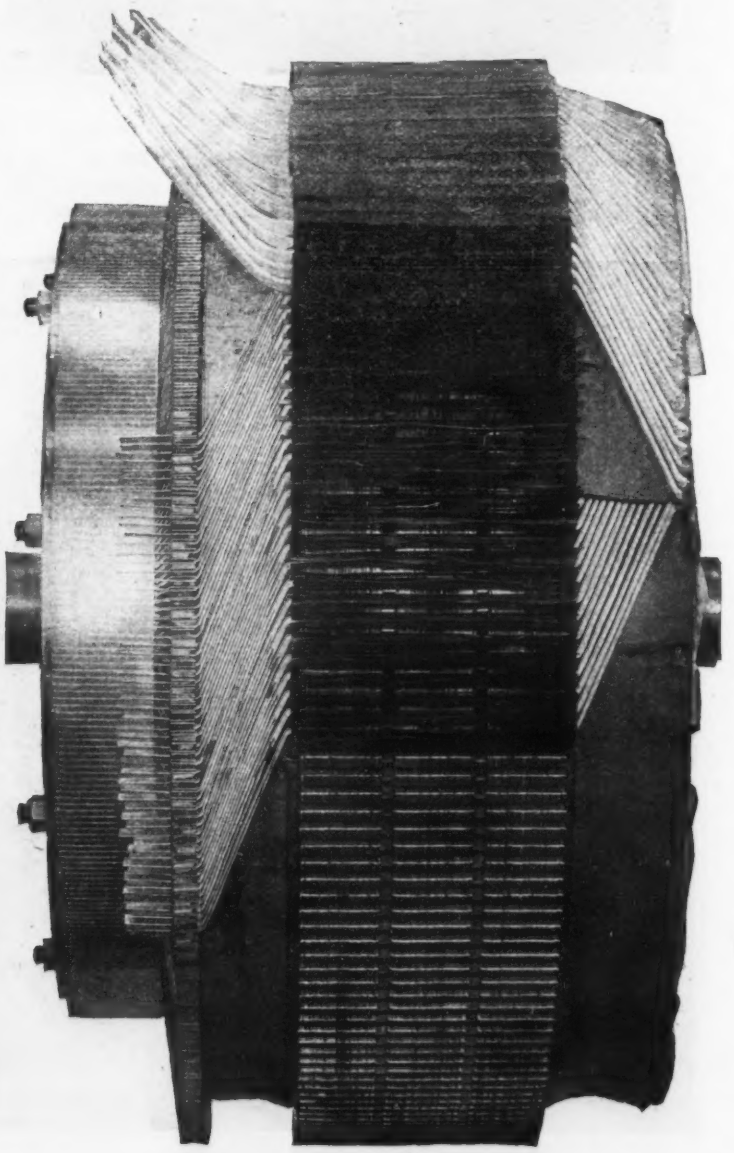


Fig. 15.—Wave Winding.

a sheet of insulating material although the insulation is already ample. The end rings of the armature are liberally insulated with fuller board and mica. Fig. 15 shows a wave winding for genera-

tors which is sometimes used. A very neat feature of these windings lies in the fact that they may be easily re-connected for lower voltages, the voltage obtained being dependent on the number of strips in the coil and the number of commutator bars. For instance, coils, each composed of five strips insulated from one another, may be so connected that by simply using a commutator having one fifth the number of segments previously required, the machine will generate one fifth the voltage and have five times the current capacity. Thus, a 550-volt dynamo could be readily turned into one of 110 volts. The armature reaction would be precisely the same and also the behavior of the machine at the brushes. The machine will operate at either voltage equally well. This great facility in utilizing the same field magnet and coils enables the Walker Company to produce both railway and lighting machines from the same designs and therefore at a lower price than they would be able to do were the designs radically different. The coils consist of flat copper ribbons tinned for convenience in soldering to the commutator. These ribbons are bent cold by a small machine, shown in Fig. 12. This piece of apparatus can bend a ribbon double on edge without producing the least distortion. The ribbon is then spread and shaped as shown in the coil in Fig. 12, the two halves of which are thus on different planes and the turn at the change of elevation is smooth and uniform. The old-fashioned way was to fold the ribbon and incidentally produce a lump at that place, which was always troublesome in the winding. This new way is practically perfect and is not surpassed by any other method of construction. The coils are held in place by wires wound in grooves turned in the face of the armature, sufficiently deep to bring the band wires below the level of the surface of the teeth. This enables the clearing space to be extremely small. The ends of the winding are covered with insulation and bound down. They are so symmetrical and neat in appearance that it is a pity to cover them up, but the dirt, oil and grease of a railway power-house demands that the greatest possible care be taken. The finished armature is shown in Fig. 14.

(To be continued.)

The Brighton-Rottingdean Seashore Railway.

The Brighton & Rottingdean (England) Seashore Electric Railway, which has already been described, has now been completed. It was officially examined by Major Marinden and Major Cardew on behalf of the railway and electric departments of the Board of Trade on Sept. 12. The car started on its trial trips at low tide, and in order to subject it to severe tests, masses of timber, concrete, and various other obstructions, including heaps of flint and chalk and large iron sleepers were placed upon the rails. The result was very successful, these things being swept aside by the car without difficulty, thus proving that anything washed up by the tide will not hinder the progress of this immense electric car. Before the trials were completed the tide was well in, the rails in some parts being covered to a depth of over 20 feet, but this offered no noticeable hindrance. At high tide the speed of the car, which is fed from overhead wires, will be 5½ miles per hour, and when the tide is out it will be six to seven miles. The line has been completed too late in the present holiday season for it to become very popular this year, though thousands witnessed the interesting trial runs.

Electric Motor Cars on the Brooklyn Bridge.

The first electric motor car to be used in connection with the railway service on the Brooklyn Bridge has been received. It is one of a lot of 20 that have been contracted for, and in general appearance does not differ materially from the passenger cars now in use. Complete the cars weigh about 36 tons each, each car having four motors, each motor weighing about two tons. The motors will be mounted upon the axles of the trucks and will have about 100 horse-power, making a total of 400 horse-power per car. It is proposed to run the motor car as a part of each train and it will carry its quota of passengers. When the train arrives at the terminals the motor car becomes operative for the purpose of switching the train after the cable has been dropped. It will start the train on the return trip, and as soon as the cables have been secured the electric current will be cut off and the cable will propel the train across the structure, as is now done. Should the cable power give out for any reason the electric power will become instantly available, and thus avoid any delay in traffic. The motor cars will have sufficient power to move the whole train across the Bridge. It is also proposed to use the electric system exclusively during the middle of the night when the cable is stopped This latter service is at present performed by steam locomotives.

The British Association.

(From Our Own Correspondent.)

It is generally admitted that the meeting of the British Association at Liverpool this year has been a great improvement upon the meetings of previous years, as regards attendance and general interest of the scientific papers read. The majority of the electrical papers went before the Mathematical and Physical Section, but the Section of Mechanical Science took several electrical papers on Monday. Among these latter was an important paper by Mr. W. H. Preece, on "Tests of Glow Lamps." Mr. Preece has adopted a system of testing lamps at abnormally high pressures, and from the behavior of the lamps he infers their quality and probable life. He has drawn up a specification based on these lines, which, however, met with considerable criticism at the meeting. A paper on the "Liverpool Overhead Railway and the Southern Extension of It" was contributed by Mr. G. B. Cotterell, the chief engineer and general manager of the railway. This railway is now being extended through a tunnel about 800 yards in length, and it is proposed shortly to increase the number of trains running. To enable this to be done two additional 400-hp generating sets are being erected at the power-house. The trains are to be increased from two to three coaches each, and will be fitted with roller bearings for the axles. It is stated that with these roller bearings the three coaches do not absorb more power in starting than do the two-coach trains with ordinary bearings. Naturally the chief subject of theoretical interest has been the mysterious X-rays and the allied cathode rays. A number of distinguished physicists took part in the several discussions which were held on the nature of these rays. Unfortunately no general agreement has been arrived at, and I may say that the English physicists have held to their original opinion as to the etherial nature of Röntgen rays and the molecular nature of the cathode ray, while the Continental physicists were unmoved in their conviction that both these rays are etherial. Sir George Stokes advanced an important hypothesis, which seemed to meet with a great deal of acceptance from the English physicists to the effect that X-rays may be due to a non-periodic impulse in the ether, that is to say, to a single kick or instantaneous blow, as it were. One very important step has been taken by the British Association this year in its decision to present to Government a resolution in favor of a National Physical Laboratory, somewhat on the lines of the German Reichsanstalt. Another important matter brought before the physical section, and one which will shortly receive international attention, is the definition of a new unit of heat. The committee having charge of this task proposes to invite international discussion on the subject, and has suggested tentatively that the primary unit of heat shall be the erg, and that for a secondary unit, 42 millions of ergs should be taken. Among the other papers of importance which were read we may notice the following: (1.) Prof. J. J. Thomson and E. Rutherford: "On the Laws of Conduction of Electricity Through Gases Exposed to the Röntgen Rays." (2.) Prof. A. W. Rucker and W. Watson read a paper showing that some porcelains are transparent while others are opaque to Röntgen rays, the opaque porcelains being those containing phosphatic china. (3.) Prof. S. P. Thompson on "Hyperphosphorescence." (4.) Prof. J. Chunder Bose, of Calcutta, on "A Completed Apparatus for the Study of the Properties of Electric Waves." Prof. Bose has arranged his apparatus after the manner of an optical bench and has concentrated into a small and compact form an instrument which for delicacy of measurements and range of working is unsurpassed by any other apparatus used for exhibiting electric-wave phenomena. (5.) Prof. J. A. Fleming, R. Beattie and R. C. Clinker: "Experiments on the Hysteresis of Iron in Revolving Magnetic Fields." This paper shows that the number of test strips used in investigating the hysteresis of a sample of iron in a magnetic field very greatly affects the results obtained, the induction in the strips being dependent within certain limits on the number of strips used. (6.) E. W. Anderson: "Notes on Electric Cranes." (7.) W. G. Walker: "Street Lighting by Incandescent Electric Lamps." (8.) Mr. W. H. Preece: "Disturbances in Submarine Cables." Mr. Preece investigates the causes and cure of various disturbances in long-distance submarine cables and applies his conclusions to ocean telephony. Lord Kelvin criticised the cable proposed by Mr. Preece and expressed the opinion that its electrostatic capacity would cause sluggishness in working. (9.) Mr. A. P. Trotter: "A Direct Reading Form of Wheatstone's Bridge." In this instrument Mr. Trotter combines the slide rule with the slide wire bridge in such a way that the measuring resistance is indicated by direct reading on a movable scale.

ANNUAL MEETING OF THE AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION

THE sixth annual meeting of the American Electro-Therapeutic Association was held on Sept. 29 and 30 and Oct. 1 in Allston Hall, Boston, under the presidency of Dr. Robert Newman, of New York City.

FIRST DAY, SEPT. 29.

The meeting was called to order at 10.30 a. m. by the president, with an attendance of about 50, augmented later on.

The first business was the adoption of an amendment increasing the number of ordinary fellows from 100 to 150. The resignations of Dr. E. H. Hayd, Dr. A. H: Goelet and Dr. Slaughter were accepted with regret, and excuses for absence on the part of Dr. W. J. Morton and Dr. Margaret Cleaves were then read. Dr. H. O. Marcy, of Boston, was introduced to the meeting and welcomed the members in a few well-chosen words, referring to the bequest of Franklin, the accumulations of which have been devoted to the purchase of Franklin Park, and the services which he rendered to the science of electricity. Dr. Marcy further referred to the advance of medical science during the past century, the probable development of the future and the aid which might be anticipated from electricity. The remarks of Dr. Marcy were all printed.

The president then read his address, dealing with the want of education in electro-therapeutics in medical colleges.

The president expressed it as his belief that the principal cause for the scepticism felt toward the application of electricity in medicine was due to the fact that the medical colleges throughout the country had failed in their duties as instructors, and that the mass of general practitioners were as a rule deficient in knowledge of electro-therapeutics, and also of the elements of physics. He had found that only a very small per cent. of the medical colleges had a course in electro-therapeutics, and that in many of them it was but superficial in its nature.

Referring to the ends accomplished by the association, the president said that:

1. It has improved its members, educated the profession and the public in and generally improved electro-therapeutics.

2. It has made electro-therapeutics a specialty and disclosed the difference between the educated physicians and the pretentious charlatans.

3. It has made friends with the physicist, the electric engineer, the electric press and harmonized them all, as will be evidenced by lectures from eminent professors, *not* doctors.

4. It has induced progress in electrical science through the comparison of the results of the labors and investigations of its standing committees.

5. It has caused improvement of electrical instruments and appliances by bringing them to a uniform standard.

6. It has awakened rivalry in establishing clinics and chairs in colleges for better instruction in electro-therapeutics.

7. It has recognition in Europe.

8. It has encouraged manufactures of instruments, producing as a result the high-tension batteries, perfect static machines, sinusoidal current, etc.

9. It has brought about progress in electric literature, new books, new journals.

10. It has produced a strong society, in which will soon be combined, for advancement, social and scientific, the ripest scientists.

Long may it live, for scientific advancement, the educating of the public, the improvement of their health, and the mutual benefit of its members by a chivalrous rivalry in scientific investigation!

The treasurer's accounts, showing a balance of $164 in hand, were audited and approved.

Mr. A. E. Kennelly was absent, but reported progress on the part of the Committee on Induction Coils and Alternators.

Dr. O. B. Douglass, of New York, then read the report of the Committee on Meters.

EXTRACT OF REPORT OF THE COMMITTEE ON METERS.

When this year's tests are contrasted with those in the tests of three or four years ago a great change for the better is seen, and the committee may be pardoned for the feeling that its work of the last last few years is accomplishing a great deal of good.

The meters of to-day are substantial and look as if they were intended for use by scientific investigators whose standard of accuracy was high. Of the 10 instruments on test only three were of the galvanometer type, whereas in the test of 1893 all but two makes of meters were of the galvanometer type. The manufacturers have shown a most earnest desire to produce such apparatus as will meet the strict demands of the profession.

After enumerating the results of tests made on the several types submitted by their respective manufacturers for inspection, the report concludes by saying that the attention of manufacturers should be called to the great need on the part of the profession for a device with which to measure the so-called Faradic currents. The methods now in use are cumbersome and unsatisfactory, in that they do not give the results in volts and amperes; neither is there any degree of accuracy. The need for a meter for this class of currents is indeed a long-felt want, and a manufacturer who produces a meter which will meet the requirements of practice will find an appreciable market.

Referring to this report, Dr. Herdman expressed his satisfaction of the test of Weston meters, as without such test he considered them uncertain. He also criticised the recommendations of the committee in some respects, stating that he, as a neurologist, found the double scale an essential feature, it being necessary to know whether a nerve or muscle responded to the polarity of the current.

Dr. Jewell referred to the difficulty of producing a meter such as required, and the necessity of eliminating outside magnetic influences. He considered the d'Arsonval type the only one which was suitable. After referring to the various forms of instruments, the speaker mentioned the desirability of some instrument for measuring the induced or "faradic" current or energy, and hoped that the committee in charge would formulate some unit with which manufacturers could work.

Dr. R. J. Nunn, of Savannah, considered that the watt alone was insufficient, as it was necessary to know both the volts and the amperes.

Dr. G. Belton Massey, of Philadelphia, and Dr. W. J. Herdman, of Ann Arbor, Mich., also took part in the discussion, and the question of danger from the use of commercial currents was incidentally referred to.

The sympathy of the members of the association was expressed on account of the absence of Dr. C. R. Dickson.

Dr. W. J. Morton reported progress on the part of the Committee on "Static Machines and Condensers," but was unable to be present.

The report of the Committee on Constant Current Motors and Generators was then read by Dr Herdman.

AFTERNOON SESSION, SEPT. 29.

On the resumption of the proceedings after the recess, Dr. F. Shavoir, of Stamford, Conn., read his paper on "Electricity in Non-Suppurative Affections of the Uterine Appendages." This was of a nature more suited to a strictly medical journal, and of a technical nature, the reader attributing the beneficial action of electricity to stimulation, increased nutrition and absorption, in combination with aseptic precautions and accuracy of diagnosis in the first instance.

Dr. G. Belton Massey then read his paper on "What Can Be Done by Means of the Use of Electricity to Avoid Surgical Operations?" The speaker referred to the attention devoted to this subject by the

great public institutions in protesting against the rude and mechanical treatment so often met with. Stress was laid by the speaker on the assimulative effect of the electric current. Over 85 per cent. of the cases referred to can be cured by electricity, as against only 25 per cent. in surgical cases. The after-effects in the latter are much worse than with the electrical treatment. The speaker also criticised Dr. Shavoir for excessive caution in the adoption of electrical methods; this excess of caution should rather be applied to surgical operations. Dr. Massey also referred to the use of iodide of potash, and suggested that the iodine was driven in, the potash remaining. Dr. Wickes suggested that the chemical action was different, and Prof. Dolbear and Dr. Nunn also referred to the cataphoretic action occurring in similar cases, either with or without the electric current. Prof. Hooper thought potash would accumulate at the positive pole. Dr. Watson also testified to the success in his practice of both galvanic and induced currents, especially in fibroid tumors. Dr. Wickes thought the time would never come when the knife of the surgeon would entirely disappear, and considered that early diagnosis and early applications of electricity would in many cases prevent the necessity for surgical operations. The vast majority of cases that can be benefited are catarrhal in nature and possibly microbic in origin, and therefore the stimulative quality of the current would probably be beneficial. In this country the results achieved by the methods of Apostoli on the other side have not been met with, probably due to haste. Dr. Nunn thought that cancer could be beneficially treated by electricity when in its early stages. Dr. Newman summed up the discussion by suggesting an alliance between the surgeon and the electro-therapeutist, admitting certain cases where the knife of the surgeon was essential.

In the absence of Dr. Beaver, of Reading, Pa., his report of a case of rectal phlebitis treated with galvanism was read by Dr. White, and a discussion followed as to the benefits of the application of electrodes of the faradic current.

The secretary read the paper of Mr. John J. Cabot, of Cincinnati, on "Accidents and Risks in Using Electricity Generated at Central Stations and Transmitted Over Underground or Overhead Wires to Operators in Electro-Therapy." Mr. Cabot referred to the dangerous condition of overhead circuits and the possible effects of crosses of high tension wires, with the wires carrying currents used for medical purposes, and also the serious results that might be brought about by lightning; lightning arresters should be used in all cases. Referring to fuses, the writer states that it is his opinion that they were entirely untrustworthy, and quoted cases supporting his view.

He stated that the usual fuse would carry from 50 per cent. to 200 per cent. over its capacity, and that it was also liable to cause fires. The writer furnished much valuable information as to the behavior of fuses, the substance of which however, is familiar to the readers of THE ELECTRICAL WORLD.

Rheostats on circuits, such as those referred to, are a delusion, as the coils of a rheostat may short-circuit and burn out, and thus become dangerous.

Mr. Cabot expresses his belief that a physician should take a course in electricity. Currents from commercial circuits should be for cautery purposes only, and the rheostats should be ironclad. The writer also suggested a form of motor generator, or dynamo for charging batteries.

Prof. Hooper made a few remarks referring to the danger of extraneous currents straying on to lines where they should not be, and that fuses were unreliable, he being in favor of a primary battery. Prof. Dolbear agreed with the author of the paper that it is safer not to employ the commercial currents for therapeutic purposes.

Dr. Herdman inclined to the view that the employment of the commercial circuits was safe, and had for seven years used a 500-volt circuit in his own office, with available voltage of about 123, the patient being in shunt circuit, lamps in series. In the West the physician is not going back to the horse-car or the primary battery. The speaker also suggested the use of transformers for cautery or lighting purposes.

Dr. Massey considered the paper a "scare-head." He considered that, at any rate, Edison circuits in large cities are perfectly safe. Fuses are no protection to a patient, and possibly the "scare" may be of use as calling attention to possible danger of overhead wires.

Dr. Henel referred to some fires caused by Edison circuits and shocks he had received from fire alarm circuits.

The paper by Dr. Max Einhorn, of New York City, was then read by the author. This dealt with the effects of direct electrization of the stomach. After referring to the negative results obtained by Meltzer in experiments on animals, the speaker enumerated cases within his own experience in which the faradic current had produced contractions and constrictions, and explained in detail the conditions under which such phenomena occur, and combated Meltzer's theory of the high resistance of the gastric mucous membrane. Dr. Herdman asked the nature of the cases in which the treatment had been used.

Dr. Max Einhorn preferred the inductive current in cases except where great pain is felt, such as gastralgia, where the galvanic current is preferable, the negative pole being placed in the stomach. "The Static Current in the Post-Apoplectic State" was dealt with by Dr. John Gerin, of Auburn, N. Y.

The semi-paralytic condition of the post-apoplectic state was described and the beneficial tonic and strengthening and sedative action of the static form of electricity referred to briefly.

The meeting adjourned until 8 p. m.

EVENING SESSION, TUESDAY, SEPT. 29.

Prof. W. L. Puffer, of the Boston Institute of Technology, delivered a very interesting lecture on "Electrical Principles Generally Used in Medical Treatment."

After referring briefly to frictional development of electricity, the electrophorous and induction machines (such as the Toepler-Holtz and Wimshurst), the lecturer explained the general principles of the dynamo, using experiments illustrating the cutting of lines of force by a conductor. He emphasized the difference in character between the form of electricity obtained from a Leyden jar or an influence machine and that produced by a battery or dynamo machine, the current; in the former case being infinitesimal, but at an enormous pressure in the latter of relatively large quantity, but at a much lower pressure.

Prof. Puffer also illustrated in a very instructive way the various kinds of discharge from an induction coil on the make, the break, and when energized by alternating currents, and suggested care and discrimination on the part of operators in the selection of the particular form of electricity to be adopted in various cases.

The lecturer elucidated the various modes in which electric energy is manifested, and the appreciation of the members was manifested by a hearty vote of thanks.

Unfortunately the condition of the atmosphere was such that experiments with the Wimshurst machine had to be abandoned.

Prof. Dolbear's instructive paper, on the "Relation of Physics to Physiology," was listened to with great interest and acknowledged by a vote of thanks, the meeting then adjourning to the following morning.

MORNING SESSION, WEDNESDAY, SEPT. 30.

The meeting was called to order by the president at 10.30, and the regrets of Dr. Wendell Philips, Dr. Apostoli and Mr. E. W. Hammer for non-attendance having been read, and other formal business attended to, Dr. Watson read his paper on "Electro-Therapy in the Treatment of the Nervous," and Dr. F. B. Bishop, of Washington, D. C., also read his paper on "The Use of the Static Cage," which two papers were discussed together. Dr. Bishop's paper was of a generally medical nature, and referred to many of the beneficial effects to be derived from the electrical method to the ozonic atmosphere developed, and mentioned the specific apparatus devised by the lecturer. The discussion was medico-technical in its nature, and was followed by the paper of Dr. Josephine G. Davis on "The Role of Electricity in the Treatment of Uric Acid Diathesis." An interesting discussion followed, in which the eliminative effect of the electric current, in combination with the increased action of the skin by baths or otherwise, was laid stress on, especially the "static" current.

"The Treatment of Strictures by Electrolysis *versus* Any Other Treatment," was then dealt with in a paper by Dr. F. H. Wallace, of Boston, and a paper on a cognate subject, "The Newman Method of Urethral Electrolysis," was submitted by Dr. F. B. Bishop.

The president, Dr. Newman, who had had considerable practical experience in this direction, exhibited various forms of sounds and catheters devised by him, and after some discussion the meeting adjourned.

AFTERNOON SESSION, WEDNESDAY, SEPT. 30.

The proceedings opened by the reading of a paper by Dr. Nunn, on "Faradism in Gynæcology." Dr. Stephen H. Weeks read a memorandum on galvanism in certain forms of pelvic disease. "The Motor-Dynamo—Adapted to Electro-Therapeutic Work," was the title of an interesting paper read by Dr. H. J. Herdman, being the joint production of himself and Mr. E. W. Hammer. The paper

was received with applause, but no discussion took place. The report of the Committee on Electrodes was submitted.

EVENING SESSION, WEDNESDAY, SEPT. 30.

The first portion of the evening session was devoted to executive business, at which the officers and committees for the ensuing year were elected :

President, Dr. W. T. Bishop, Harrisburg, Pa.; vice-presidents, Dr. Emil Heuel, New York, N. Y.; Dr. F. B. Bishop, Washington, D. C.; treasurer, Dr. R. G. Nunn, Savannah, Ga.; secretary, Dr. Max Einhorn, New York City.

The remainder of the evening was spent in social recreation, refreshments being served in the parlors connected with the hotel, the presence of the ladies, and music, adding agreeable features to the evening's entertainment.

MORNING SESSION, THURSDAY, OCT. 1.

The first paper read was that of Dr. W. J. Herdman, on "The Application of Electricity to Surgery."

Mr. C. E. Dolbear, son of Prof. Dolbear, then gave an informal exhibition of Röntgen-ray apparatus, and explained a few matters in connection with its operation.

After a hearty vote of thanks to Mr. Dolbear the newly elected president, Dr. W. T. Bishop, took his position as successor to Dr. Newman.

At almost the close of the proceedings an exhaustive paper arrived from Dr. Margaret A. Cleaves (prevented by sickness from attending), the title of which was, "The Expenditure of Electric Energy." The paper was read by title, but will be revised by Dr. Cleaves and appear in the Transactions of the association.

The formal business being ended the meeting adjourned, next year's place of meeting to be Harrisburg, Pa., Sept. 21, 22 and 23, when it is hoped that the numbers attending will be larger, the absence on the present occasion of strictly electrical members being regretable.

In the afternoon a respectable contingent of the members proceeded on the invitation of the General Electric Company to its works at Lynn, where Professor Elihu Thomson showed some very interesting Röntgen-ray apparatus and performed some instructive experiments with high-frequency, high-potential currents, illustrating the very slight physiological action of such forms of electric energy, notwithstanding the enormous pressure involved. These experiments were new to many of those present and great interest was manifested in the proceedings.

EXHIBITS.

In an annex to the auditorium an exhibition of various forms of electro-therapeutics had been arranged, under the supervision of Dr. Frederick H. Morse, of Melrose.

A large static machine of the Morton-Wimshurst type was exhibited by the Galvano-Faradic Company, of New York, as well as numerous electrodes, sound probes and other of their well-known electrical specialties. The McIntosh Battery & Optical Company, of Chicago, were ably represented by Dr, Jewell, who presided over a very interesting exhibit of their instruments as well as the Jewell Cautery Transformer.

The Wait & Bartlett specialties were shown by Mr. Goldthwaite, of Boston, who had a very fine display.

The old established house of the Jerome Kidder Manufacturing Company gave an exhibit of coils and other apparatus of their well known types.

The Stanley Dry Plate Company, Newton, Mass., exhibited Röntgen photographs, and W. H. Phelps & Co., Boston, who also make a specialty of this form of photography, were represented.

So likewise were Messrs. G. A. Frei & Co., who manufacture Crookes tubes and other appliances.

The Zeigler Electric Company, Boston, was represented, but owing to press of business was prevented from making an exhibit of its induction coils, Wimshurst and Holtz machines and other electro-therapeutic apparatus. The members were invited to call at their factory and salesrooms and inspect their stock.

Electric Power in the Hoosac Tunnel.

It is reported that the directors of the Fitchburg Railway Company have under consideration a plan for hauling trains through the Hoosac Tunnel by electric power. It is proposed to establish for the purpose of generating the power a large plant at the west end of the tunnel.

Present Status of the Distribution and Transmission of Electrical Energy.*

BY LOUIS DUNCAN.

The industrial life of mankind is made up of two things, the transformation and distribution of material and the transformation and distribution of energy. The raw material from mines and forests is changed to finished products and distributed among the people, while energy, obtained from water-power, coal or other sources, is changed from the potential energy of the water or the energy of chemical combination to mechanical power, heat, light, etc. Unless we can transmit this energy economically, we must transform it into the required form at the place where it is to be utilized. At present a large part of our mechanical power is obtained from steam plants situated in the factories themselves, and for heat and light we mainly depend upon stoves and lamps in our houses.

Before the introduction of electrical transmission it was possible to distribute energy to limited distances by various methods, but no system offered a long-distance transmission for all purposes. By means of compressed air or steam pipes the energy of coal has been transmitted to produce mechanical power or for heating, and gas mains have allowed the distribution of gas for lighting or for fuel.

In the case of power obtained from steam plants the economy incidental to large units and a steady load has led to the concentration of industries. Where steam is used the plants are situated where it is most convenient for manufacture. Where water-power is employed it is necessary to bring the factories to the location of the power, irrespective of other conditions.

By means of dynamo-electric machines the energy obtained from either coal or water-power may be transformed into electrical energy; may be distributed and then transformed again into mechanical power, light or heat, or may be used for a number of purposes peculiar to this form of energy alone. The limits to the distance of this distribution are imposed by conditions of economy and safety.

It is my purpose to take up the different methods of transmission and distribution and to consider the limits that are actually fixed by the present status of electrical development. The question is a commercial one, each problem presenting different conditions which must be considered, but certain general principles govern each case, and our knowledge and experience makes it possible to judge the practicability of each particular transmission.

GENERATING PLANTS.

At the present time practically all of the electrical energy distributed is generated in plants operated either by steam or water-power, and it is important to consider the conditions of maximum economy in large generating plants, as this bears directly on the subject of transmission and distribution.

A large proportion of the electrical plants in this country are steam plants. In the last 10 years we have advanced from small stations using high-speed dynamos for light and power distribution to large stations using, as a rule, low-speed direct-connected machines. The simple engines that were used some years ago have, in many cases, been changed to compound and even triple-expansion engines, and where it is possible condensers have been employed. Some of the latest plants have machinery of the highest possible efficiency, and yet if we consider the price per horse-power of the power generated, we will find that it is greater than we expect. This is partly due to the fact that for both lighting and power purposes the load on the station is, as a rule, not uniform, and the apparatus is not working under the best conditions for economy. In this country electrical energy is principally generated for electric lighting, for electric traction, and for supplying stationary motors, the stationary motors, as a rule, being supplied with current from lighting stations. If we take the load-diagram of such stations in large towns, we will find that the average output is not greater than 30 to 40 per cent. of the maximum output. We have therefore to supply a large amount of machinery corresponding to the maximum demand on the station, while for distribution a large amount of copper is required that is only being used at its maximum capacity for a comparatively short period of the time. In stations supplying power for traction purposes we find a variation of load, but the variation is a different kind from that found in a lighting station. In the latter the load varies at different hours in the day, but for any particular instant it is practically constant. In the former the average load

* Inaugural address before the A. I. E. E., Sept 23, 1896.

for different hours during which the station is operated will be practically constant, but there will be momentary variations depending upon the size of the station and the type of traffic. Taking for instance a 2000-hp station in Baltimore, I find that the average load is 48 per cent. of the momentary maximum load. This difference in the line of variation for the two types of stations necessitates employment of different apparatus to obtain the maximum economy for each type. For lighting stations triple expansion engines may be used, while for traction work, where the variation in the load is sudden and may occur after the steam is cut off from the high pressure cylinder, it is not well in general to go beyond compound engines, and there is even a question as to whether simple engines are not more economical when condensing water cannot be obtained. In any case, however, it is of the utmost importance as regards economy of operation that the load should be made as constant as possible.

Two distinct types of distribution are used for incandescent lighting in this country—the single-phase alternating current and the direct current three-wire system. At the present time the former does not permit the supplying of power. As alternating distribution is at high potential it does permit the location of the station where the conditions of maximum economy can be fulfilled. The three-wire incandescent system using low voltages may be used for supplying motors, but the amount of copper necessitated by the low pressure has caused such stations to be located near the centre of distribution irrespective of the best conditions for the economical operation of the plant.

With the alternating system it seems impossible to provide even a moderately steady output, but with the continuous-current system the motor load during the day gives an average output greater in proportion to the maximum. Some years ago the question of the relative values of the alternating and direct current systems was discussed, and for a while most of the stations installed were of the alternating type. At present the tendency seems rather in the direction of continuous-current stations, especially in towns where there is a large demand for current within a comparatively small area. There is a great advantage of direct currents in that they allow the employment of storage batteries, which equalizes the load on the station. In almost all of the large lighting plants, both here and abroad, this plan has been adopted to a greater or less extent, and the results have been so favorable that the battery equipments in many of our stations are being increased. The efficiency of batteries in lighting stations is comparatively high, while the depreciation has been greatly reduced, and is not now over 5 or 6 per cent. per annum. In most systems, however, the full benefit of the storage batteries is not realized, as the batteries are placed in the station, and while the advantage of an approximately constant load is obtained, yet the further advantage offered in distribution is not secured. I will take this question up later.

In New York, Brooklyn, Boston and Chicago a large proportion of the direct-current lighting stations are situated where it is expensive to handle the coal and ashes, and where the economy due to condensation is not obtained. It is also the custom to use several stations instead of a single large station, and this increases the cost of production, both in operating expenses and fixed charges. The question arises whether we have reached a point where it will be more economical to consolidate the stations in the best possible location for economical production of energy, and make use of the means of distribution which have been developed in the last few years to increase the radius at which energy can be supplied.

As far as traction stations are concerned, their efficiency and output would be increased by the use of batteries, both because the machinery would be steadily loaded and because the most efficient type of apparatus could be used, as is the case in lighting stations. By the consolidation of railway properties that has taken place in the last few years single corporations operate electric lines over extended areas. It is the custom to build a number of stations, each running a certain section of the line, the idea being that the decreased cost of copper and the decreased possibility of a shut-down would more than compensate for the increased cost of operation and fixed charges. It is, again, important to consider the question whether we have not reached the point where a single station can be built in such a way that there is little or no possibility of any accident causing a suspension of the entire traffic of the system, and where improved methods of distribution will decrease the amount of copper so that it will not exceed that required by the present method of using a number of generating stations.

If storage batteries are used the two types of variable load belonging to lighting and power stations demand different types of battery. For lighting stations a considerable capacity is required, while the momentary variations of power stations do not require any great capacity, but demand as great a maximum output as battery manufacturers can obtain.

In water-power plants the conditions of economy are different. The location of the plant is, of course, definitely fixed, and the advisability of obtaining a uniform load, by means of batteries, depends upon the local conditions. If the water-power is limited and is less than the demand, then it might be well to use batteries in order to increase the amount of salable power. Again, if the development is expensive, it might be cheaper to develop a smaller amount of power, pay for a smaller amount of machinery and increase the output by the addition of batteries. These are questions that can only be decided by a knowledge of the local conditions.

We may conclude that while the practice in large lighting and traction systems is to multiply stations near centres of consumption, yet the economy of a single large station makes it important to consider whether it is not possible to concentrate our power at some point where the expenses will be a minimum and distribute by some of the methods which have in the last few years proved successful and economical. It is important to make the station load steady, and this may be done for continuous-current lighting and traction plants by means of storage batteries.

ELECTRICAL DISTRIBUTION.

The distribution of electrical energy to consumers as distinguished from its transmission to long distances, has been largely accomplished by the agency of continuous currents, although alternating currents have played an important part in incandescent lighting. As I have stated, a considerable proportion of current for lighting is distributed at constant potential on the three-wire system, or at constant current on arc light circuits, while power for traction circuits is distributed at approximately constant potential at an average of say 550 volts.

I shall first consider the condition of affairs in a traction system in a large city, where a number of suburban lines are operated. If direct distribution is attempted from a single station, it will be found that when the distance exceeds five or six miles a large amount of copper must be employed to prevent both excessive loss and excessive variation of potential on the lines. On suburban lines it is the latter consideration that usually determines the amount of copper used, and this is especially true on lines where there is a considerable excursion traffic. Even in the city itself, the supplying of sections at distances three or four miles from the station may require so much copper that it would be less expensive to operate separate stations. Several methods other than the direct method may be employed to remedy these difficulties. For outlying lines where the traffic is mainly of the excursion order, being variable both during the day and for different seasons, boosters may be advantageously used. It is perhaps best from reasons of economy to run the boosting dynamos from motors. These dynamos are series-wound and are connected to feeders of such resistance that the fall of potential in the wire for a given current is compensated, or by the rise in voltage of the booster. There is a decreased cost of copper incidental to the system, due to the fact that the drop is not limited by consideration of regulation—the voltage at the end of the feeder being constant—while the transmission is at an increased potential. If the average station potential is 600 volts, and it is boosted 300 volts, then the copper for a given loss would be decreased in the ratio of 36 to 81. The booster system has the advantage of the direct system when the cost of the additional apparatus, together with the increased loss on the line, capitalized, is less than the increased cost of the copper necessary to produce the same result by the direct system. Whether the balance is in favor of one or the other depends on the distance and the variation of the load, and it is indifferent whether the variation in the latter occurs often or not.

If any transforming device is employed to feed a distant section of the line it must be remembered that the capacity of the device must be great enough to look out for the maximum demand on this section. Suppose now that we wish to feed some suburban line where the load has considerable momentary fluctuations, but where the traffic is moderately constant during the year. In this case the booster could be used with a storage battery at the end of its feeder, the battery supplying the line. The advantages of this combination are greater than with the simple booster, and in many cases they will compensate for the interest and depreciation on the battery and the loss in it. If the arrangement is properly made, the load on the

booster and line wire will be practically constant, thus decreasing the capacity of the booster to that required for the average load, while less copper will be required for a given loss. As to the latter point, suppose a given amount of power is to be distributed in 24 hours, say 200 amperes at 600 volts; if the load is uniform the loss will be proportional to $200^2 \times 24$ hours. If it is all distributed in 12 hours, the loss will be proportional to $400^2 \times 12$ hours, or twice as much. So in the case of the steady load the same power could be transmitted with the same loss with half the copper. It makes no difference whether the variation extends over 12 hours in 24 or it occurs every other minute; the result will be the same. It is apparent then that it is of the utmost importance to keep the line steadily loaded, as well as the station, and this points to the location of the battery near the points of consumption and not in the station. By this system—a booster with storage batteries—it is possible, assuming the same loss, to transmit power to a distance of 10 miles with approximately the same amount of copper that would be required for a five-mile transmission on the direct system. It would increase the economical radius of distribution twice, and the area of distribution four times. A single station could economically support lines within distances up to 10 or 12 miles. If it is desired to still further increase the radius of distribution, it is possible to do this by employing some of the alternating-current methods that have come into use. I will discuss these methods later, but at this point I may remark that the use of stationary and rotary transformers permits the energy to be transmitted in the form of alternating currents, and to be changed again into continuous currents of any required voltage. These rotary transformers, supplied by an alternating current which is transmitted from the station at a high voltage, may be used to feed the line directly, or they may be used to supply storage batteries which are connected to the line. In the latter case we have the advantage of decreased size of apparatus, of steady load on the station, and of a minimum cost of copper on the line; which system it would be best to employ would depend upon the distances and the character of the line and load.

Of the systems that I have proposed for city and suburban distribution from a single station, three have been successfully employed, namely: The booster system, the booster system with batteries, and rotary transformers operating directly on the line. When we consider the advantages of a single station and a steady load, it seems evident to me, that many of the large traction systems would do well to concentrate their stations into one and to use the booster system with batteries for their outlying lines, and if necessary use rotary transformers for lines beyond the limit of ordinary suburban work. As to the possibility of the complete shut down of such a station, we have reached such a point in the construction of machinery, both electric and mechanical, that with a proper reserve, a careful system of duplex steam piping, and with fire proof construction of the station, such a possibility may be disregarded, while the batteries would look out for any momentary interruption on the feeders.

CONTINUOUS-CURRENT LOW VOLTAGE DISTRIBUTION.

Some of the most important stations supplying incandescent lamps are operated on the three-wire continuous-current system. In the last few years a considerable advance has been made in the sale of power for motors from these stations, and this has increased the revenue and has given better average output. The tendency in this country has been in the direction of using storage batteries in such stations, and abroad practically every continuous-current station uses batteries. As in the case of traction systems, it has been the custom in large cities to build a number of separate stations, instead of building a single plant and distributing from it. The batteries have been placed in the stations themselves and no attempt has been made to decrease the amount of copper used by employing a number of centres of distribution, and giving the main feeders a steady load. The same considerations that apply to stations for traction work will also apply to stations used to supply lights, and the same methods of distribution may be used. It would unquestionably be more economical, in many instances, to use single stations, to transmit power from these stations to centres of distribution, where batteries may be located and to distribute from these centres on a three-wire system. A case in point is the system used at Buda Pesth, where the energy is distributed from the central station to rotary transformers at sub-stations, these rotary transformers feeding batteries, current being distributed from these batteries on a three-wire system. The reports of the operation of this station show that it is both economical and successful, and it might well be copied by some of the companies in this country. The gross receipts of some of the large illuminating companies bear such a large proportion to the company's stock, that a comparatively small saving in operation would mean a considerable increase in the dividends, and there is no doubt in my mind that by using one power station, with battery sub-stations for distribution, that the operating expenses can be considerably decreased.

ALTERNATING CURRENTS FOR LIGHTING.

Alternating currents have been employed for lighting in this country, and they have been especially valuable where a district is to be supplied in which the distances are considerable as compared with a number of customers. It has been almost the universal custom to supply small transformers for each consumer, and while the average size of transformers is greater now than it was a few years ago, yet they are comparatively small. No power has been supplied from such stations, and although alternating arc lamps are used to a limited extent, yet the number is not increasing, and in some cases continuous-current arc lamps have been substituted for the alternating. Under these conditions the load on the station is even more variable than in the case of a continuous-current supply where motors may be employed, and the constant loss due to the large number of small transformers used, places this system at a disadvantage as compared with the continuous current system. The great advantage it possesses lies in the increased area of distribution rendered possible by the high voltages that are used, together with the possibility of locating the stations where power can be cheaply made. Abroad in the last few years most of the new stations that have been built use continuous-currents, although some years ago the greater proportion of them were alternating-current stations. It is also the custom abroad to use sub-stations with large transformers for distribution, thus doing away with a considerable part of the constant loss due to the small transformers used here. It is not possible, at the present time, without greatly complicating the system, to obtain a steady load on the station, and the only question that arises is the value of sub-stations, and the possibility of using some form of alternating-current other than the single-phase.

METHODS OF ELECTRICAL TRANSMISSION.

Coming to the question of transmission of electrical energy as distinguished from the supply to customers from distributing centres, there have been great advances made in the last few years, and these mainly through the introduction of multiphase alternating-currents. Single-phase alternating-currents permit the transmission of power to long distances and its distribution for lighting purposes. It is also possible to supply power from such circuits to large motors working under a steady load. It is not possible, however, to distribute power economically for ordinary uses. As most long-distance transmission schemes contemplate the substitution of electric motors for steam engines, and as their success will, in many cases, depend upon the possibility of such substitution, single-phase alternating-currents are not at present able to comply with the conditions imposed by the desired service. The introduction of multi-phase alternating systems, where two or more alternating-currents are employed, the currents differing in phase, has completely changed the situation with respect to long-distance transmission. I shall consider briefly the possibilities of such systems and their value as compared with any direct-current system.

(*To be continued.*)

Electric Traction on the Third Avenue "L" Road, New York.

There will shortly be placed in operation on the Thirty-fourth Street branch of the Third Avenue Elevated Railway, New York, an electrically equipped train which in its methods of operation will introduce new ideas and a radical departure from those hitherto employed in electric railway work.

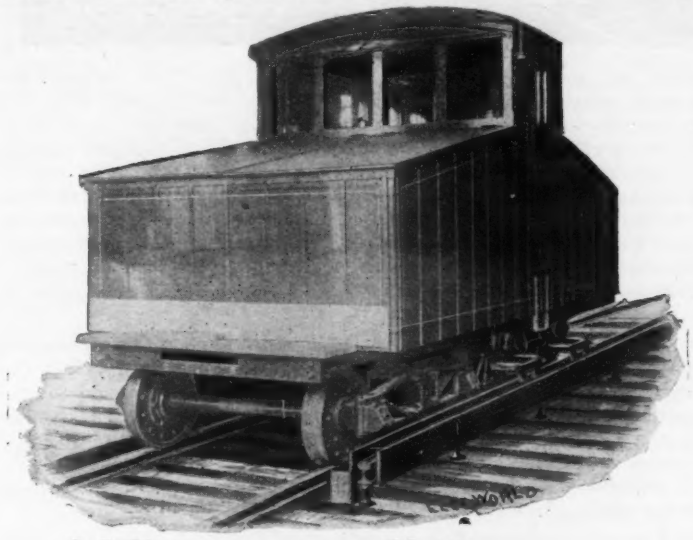
A third-rail conductor, placed outside of the main track, and similar to that used on the Lake Street "L" road of Chicago, will, in conjunction with the main track, supply the current at 500 volts pressure to an electric locomotive which has been constructed in the shops of the Manhattan Elevated Railway, and which is similar in appearance to those now being used in the Baltimore tunnel.

The electrical equipment consists of two 125-hp G. E.-2000 single-geared motors controlled by the ordinary series-parallel controller. The air-brakes will be operated from the axles of a small bogie truck. Instead of having one trolley shoe suspended from the centre of the truck frame there are two, each supported directly under the journal boxes of the two main drivers, as shown in the illustration.

The system is a combination of storage battery and trolley traction, each locomotive carrying an equipment of 256 cells. The battery is

connected across the main over the wheels and the third rail. The terminals of the motor system, which, as before stated, is the ordinary series-parallel combination, are also so connected.

Before going further a few words about traction batteries may be of interest. There are two types of battery. One carries in its plate pastelles of active material which constitutes a system of thick local deposits. Until lately it was supposed that this was a superior method. The other system is to use a plate of enormous surface,



ELECTRIC LOCOMOTIVE.

and very thin deposit. It has been found that the truly active material was only a few one-hundredths of an inch thick, and that the outer material did not oxidize and reduce as the cell charged and discharged. Therefore it is rather a dead than an active material, and merely increases the internal resistance of the cell, so that it is likely to become supplanted by the large surface and thin deposit method, by means of which a triple gain is realized. The internal resistance of the cell is largely reduced, the area per ampere of discharge is increased, and the capacity of a given weight of load is also largely increased.

It is pretty universally admitted that the process of pasting plates is obsolete. Paste is sure sooner or later to come out, while the life of a Planté formation is longer, and as the oxide sheds new material is formed, the lead core gradually wasting away. The life of the plate therefore is that of the lead core, and that can be varied to suit any conditions. The method of forming these plates was originally to paste them, assuming that by the time the paste had fallen out that the Planté formation would be complete, and the plate would thus be even better than on the start. In the modern way the latter condition is arrived at at once, the Planté formation being produced by a very rapid electro-chemical process. The construction of these plates is such that buckling is an impossibility, and enormous rates of charge and discharge, it is claimed, can be used with impunity.

It is an established fact that the use of a storage battery or any system of electric power reduces the size of the plant required and evens up the load. When the cars are not taking current the storage battery is being charged, and should an excessive demand for current lower the potential at any point in the system, both dynamos and batteries deliver their current at that point. The nearer the battery is to the point where the potential is pulled down by excessive demand the better will be the result. The use of the batteries at the locomotive accomplishes this to theoretical perfection. The moving-point of low potential is followed up by a moving storage battery plant, which is thus exactly where it is most needed. Once installed on the locomotive the batteries take care of themselves and automatically charge and discharge.

They charge when the car is descending grades or when it is comparatively isolated on the line near the power-house, and they discharge when the car is ascending a heavy grade or where there is a congested traffic. Whenever the locomotive calls for less than the average amount the battery charges at a rate equal to the difference between the amount called for and this average current, and when the demand on the locomotive is excessive this excess is made up by the battery. Thus the conductors can be proportioned for and will always carry the average load, and the potential at the locomotive is practically a constant quantity.

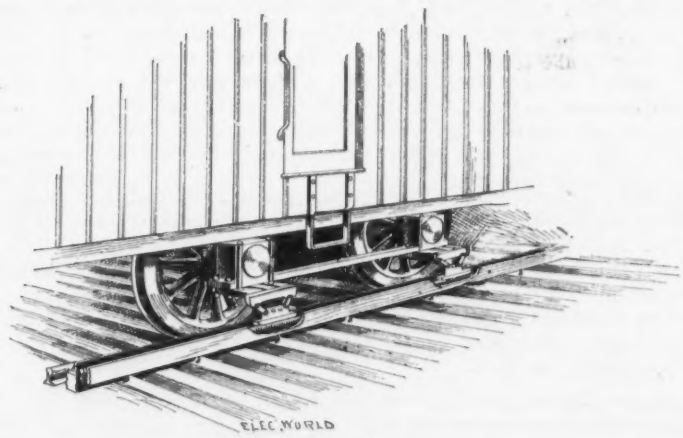
The function of the battery, which is in parallel with the motors, is to maintain in the conductors a constant load independent of the load demanded by the locomotive, and it will supply an amount of current equal to the average demand of the motors. When this demand is in excess of the average the battery will discharge, thereby supplying the excess, and when less than the average the battery will be charged, making up for the difference. The battery in eliminating these fluctuations keeps the potential at each locomotive practically constant, so that it is possible to install line-conductors and feeders which shall have a carrying capacity equal only to the steady average current. If the conductors are figured for the most economical drop considering at the same time the variable nature of the load throughout the twenty-four hours as well as its violent fluctuations on the motors, it will be found that the drop is considerably in excess of that with which it would be possible to operate if this variable load was maintained through the feeders and conductors. Further, the current supplied to the locomotive can be diminished when the locomotive is at the greatest distance from the power house and increased when nearer, the battery automatically charging and discharging to compensate for the difference. Since for a given drop the amount of copper varies as the square of the distance, it will be seen that by increasing the current for short distances of transmission and lessening it for maximum distances a considerable saving may be effected; in fact it has been calculated that this saving will amount to from one third to one fourth.

No congestion of trains on any portion of the road can affect the operation whether the system is supplied from one power-house or several, as the batteries are always distributed in the same manner as the trains.

The capacity of the power-house is reduced by one third, and a similar reduction of the coal bills must ensue. In addition, the engines and dynamos working at full load and high economy by their increased efficiency still further reduce the coal consumption, the total saving being, it is said, often 50 or 60 per cent.

Another advantage which this system has is that it is only necessary to run the third-rail conductor on the straight portion of the track, making it unnecessary to maintain the speed of the train over crossings and switches. In the car barns also all conductors are done away with, the train being propelled by the battery alone.

As the batteries on each locomotive are connected together and therefore mutually dependent, the tendency is for all of them to work in harmony, each supplying its share of output at any congested point. The advantage to be gained by such an installation over, for instance, the practice of placing the batteries all in the power-house or distributing them in groups at the ends of the various feeders along the line, is obvious. In the former case the line under-



TROLLEY SHOES.

goes all the fluctrations of load brought about by the service, only maintaining a constant load on the generator. In the second case where the batteries locally feed into the system any congestion of traffic of any particular point will naturally throw an excessive demand upon the battery located at that point.

The battery installed on the locomotive soon to be put in operation on the Third Avenue line will have a capacity sufficient to propel an entire train from 10 to 15 miles, a distance greater than the length of the line.

This system has been worked out under the supervision of Mr. J. B. Entz, representing the Electric Storage Battery Company, who will oversee its operation.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

BY CARL HERING

COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS.

DYNAMOS, MOTORS AND TRANSFORMERS.

Sparking. FISCHER-HINNEN. *Elek. Zeit.*, Sept. 17.—The first part of an article of a mathematical nature, in which he endeavors to develop a formula by means of which the shifting of the brushes, or what in most cases amounts to the same thing, the sparking, can be predetermined by calculation; heretofore no such formula has existed; it is only approximated; in the present portion no conclusions are given.

The Actions in Armature of Three-phase Motors. ROTHERT. *Elek. Zeit.*, Sept. 17.—An unfavorable criticism of the recent article of Bauch (see *Digest*, Sept. 26).

Energy Losses in Dynamos. CORSEPIUS. *Elek. Zeit.*, Sept. 17.—A brief continuation of this discussion in the form of a reply to the remarks of Dettmar (see *Digest*, Sept. 26).

LIGHTS AND LIGHTING.

Illumination in Public Streets and Squares. LUX. *Zeit. f. Beleucht.*, Aug. 30 and Sept. 10.—Descriptions of methods for calculating the illumination from a number of lamps at given distances apart.

Lighting by Acetylene. PELLISSIER. *L'Eclairage Elec.*, Sept. 12.—A continuation of his article (see *Digest*, Sept. 26); he describes and illustrates the electric furnaces used at Spray, Niagara, and the one devised by Bullier.

Apparatus for Public Lighting. *L'Energie Elec.*, Sept. 1.—An article containing a large number of illustrations of arc light fixtures for street lighting, most of which are those used in foreign cities.

Spectrum of Reflection and the Efficient Illumination of Confined Space. BIRCHMORE. *Elec. Eng.*, Sept. 30.—The first part of an article showing the importance of studying the spectrum of light reflected from the surfaces on which it falls, a subject which he thinks has not received the attention it deserves; since his earlier paper on this subject (see *Digest*, Jan. 11) he has collected a large amount of data, some of which he gives. He believes that the improvement which is needed in lamps is not increased emission, but an emission of a different wave-length.

POWER AND HEAT.

Comparative Tests of a Gas and an Electric Motor. *Elec. Tech.*, Sept. 15; translated in abstract from *Genie Civil.*—A report of some tests made with a 6-hp gas engine and a 4.5-hp electric motor. Among the results were the following: After running the gas engine seven days without cleaning, the consumption of gas increased 23 per cent.; the consumption of the engine without load was 40 per cent. less than with the full load of 6 horse-power; with gas at the rate of 6 cents per cubic metre, the cost of running the gas engine per hour without load was 20 cents and with full load 41 cents (this does not appear to include amortization and interest although it includes maintenance); for the electric motor the figures were 6.6 cents for no load and 49 cents for full load, this including amortization and interest; the current is charged for at the rate of 12 cents per kw-hour; the figures of the gas engine are then reduced to those for 4.5 horse-power, which shows that the consumption of gas is 56 per cent. of that at full load, while with the electric motor it is only 13 per cent.; it is concluded that if the power is required continuously the gas engine will be cheaper, but if required only intermittently the electric motor would be more economical; for larger powers the gas motor would be the more economical; but the electric motor would have some other advantages in its favor.

Electric Turret Gear for French Warships. *La Nature*, Aug. 29; abstracted with the illustrations in the *Elec. Eng.*, Sept. 16.—An illustrated description of the arrangement.

Electric Mining in the Rocky Mountain Region. HALE. *Eng. News*, Oct. 1; a long abstract of a paper read before the American Institute of Mining Engineers.—He discusses the advantages of electric power, the counter considerations and the conditions affecting the cost of the plant, after which he describes the systems and the machinery, concluding with a brief reference to electro-metallurgy and future developments; in connection with the latter he states that during the past eight years, and chiefly during the last four, 52 distinct companies in the Rocky Mountain district have installed electric machinery for mining and ore-reducing purposes, comprising 62 generators aggregating 7588 kilowatts and 135 motors aggregating 4816 horse-power; the electric apparatus has now been brought to such a degree of perfection that depreciation and repairs may be considered as less on this than on any other kind of machinery; the multiphase high-voltage system has brought nearly every mining district within economical reach of water-power; the induction motor is the acme of simplicity and durability; electro-metallurgical operations are increasing and give promise of success; during the next five years much greater progress will be made and the application of electricity will become one of the most attractive and important features of mining economy. His paper contains a table of the cost of copper required to transit one kilowatt various distances; another, containing a list of electric power plants for mines, mills and smelters in the Rocky Mountain region with some tabular information for each.

Electricity in Naval Life. FISKE. *Elec. Eng.*, Sept. 30; a continuation of the reprint of his article (see *Digest*, last week).—He discusses the electrical operation of turrets, pointing out the advantages and the requirements, one of which is constant speed with a varying load, owing to the oscillations of the vessel. The subject of steering by electric motors is briefly discussed and is considered as a doubtful expedient. He then discusses the electric firing of guns, showing that more accurate firing can thus be accomplished than with percussion or friction.

Transmission Plant of the Big Cottonwood Power Co. *Eng. News*, Oct. 1.—A long, well-illustrated description of this plant with special reference to the engineering features.

Gas vs. Electricity Direct from Coal. DUNNING. *Elec. Rev.*, Sept. 30.—A beginning of a reprint of the article noticed in the *Digest*, Sept. 12.

Relations of Electricity to Steam and Water Power. EMERY.—A long abstract of the paper noticed in the *Digest* last week.

TRACTION.

Return-Current for Electric Railways. CRUCIANI. *Bull. l'Ass. Ing. El. Montefiore*, May 30.—An article of some length discussing the subject of return-currents and the means for avoiding their evil effects; he discusses a number of those which have been proposed, and more particularly the one in which auxiliary return feeders are used and the one in which an auxiliary dynamo is used; he compares these last two by working out an example in each case, showing that for auxiliary feeders an enormous amount of copper would be required to reduce the loss in the rails to seven volts, while with an auxiliary dynamo the amount of power required for it is only about 5 per cent. of the total, showing the advantage of the latter method; this is really a three-wire system, one branch of which is formed by the trolley wire and the rails while the other is formed by the rails and the feeders for the auxiliary dynamo, the rails thus being the neutral wire.

Electric Railway from Meckenbeuren and Tettnang. *L'Ind. Elec.*, Sept. 10.—An illustrated description of this railway near Lake Constance, which is of interest as it is one of the first electric railways in Europe having the normal gauge of railways and being used for passengers and freight with a regular scheduled service; it has been in operation for about a year and was constructed by the Oerlikon Company, the trolley system being used throughout; the power is obtained from a waterfall; 700 volts are used; the power-house is also used for lighting the two towns.

Three-Phase Traction. Lond. *Elec. Rev.*, Sept. 18.—In connection with a description of the exhibits of the Geneva exhibition it is stated that the railway plant at the copper mines of the Boleo Company and at the coal mines of the mouths of the Rhone are being worked by tri-phase currents; no further information is given.

Accumulator Traction in Paris. PELLISSIER. *L'Eclairage Elec.*, Vol. 6, page 49; abstracted in the *Proc. Inst. Civ. Engs.*, 125, No. 3.—He gives a brief discussion of the subject of accumulator traction in Paris and some data of the existing plant.

Heilmann Locomotives in Russia. *Elek. Zeit.*, Sept. 17.—A note stating that the Russian Government intends to lease four electric locomotives of the Heilmann system for the Russian railways; two of them are to be capable of drawing an express train of 380 tons at a speed of about 64 miles an hour; the others are to draw a freight train of 1000 tons at a speed of about 25 miles an hour; the rent is to be about 8½ cents per km for the express and 9.75 cents for the freight service, this price including amortization.

Compressed Air Traction. BAXTER. *Elec. Eng.*, Sept. 30.—A discussion of the question of whether compressed air will become a rival of electricity in that field; he states that the cars which are being tried in New York City are run under very favorable circumstances; he answers

a number of the claims made in favor of the compressed air system, which claims he considers are not well founded; the compressed air system has been in use for many years and it has always failed; the cars strain the track, as they are about two tons heavier than the electric cars; it will not be possible to run them on the ordinary horse-car tracks with success; the time lost in charging may become 10 or 15 minutes, which is an important amount; efficiency is only one of the factors, and perhaps not the most important one, such features as the reliability, cost of repairs and ability to meet abnormal requirements being fully as important; compressed air cars will certainly not do as well in regard to reliability as steam locomotives, their moving parts being constantly covered with mud and grit; the cost of repairs must necessarily be greater than in electric cars; it is probable that the motors may be made sufficiently perfect to gain a foothold where the trolley is not allowed; in the cost of the plant there appears to be but little room for gain; the cost of maintenance would certainly be greater, as also the operating expenses, and there is little doubt that the efficiency is lower.

Electric Locomotives in the Hoosac Tunnel. *Elec. Eng.*, Sept. 30.—A statement that an official of the railway intimated that the trains through the long five-mile tunnel will soon be worked by electric locomotives.

Electric Car for Street Cleaning. *West. Elec.*, Oct. 3.—An illustrated description of the Reynolds self-loading car mentioned in the *Digest* last week.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Small Electric Light Plant for a Country House. Lond. *Elec. Rev.*, Sept. 18.—A brief description of a small plant in South Wales, intending to show that the idea that the cost is prohibitive is a fallacious one. The plant consists of an oil engine and dynamo, an accumulator and a switch board, all contained in a space of 14 feet x 6 feet 6 inches; it is operated by the gardener and requires his attention only at intervals of two hours; it is run for 10 hours at a time, which for Summer months is enough for a three days' supply, and for Winter months about two days; there are 25 lamps; two cents worth of "paraffin" (presumably meaning the oil) consumed in the engine is sufficient to keep eight lamps of 16 candle-power burning for one hour; the bill for fuel is fully covered by $35 per year, which is said to be the whole cost of working besides the attendant's time, which is very small; the initial cost of everything except the building was $1000.

Zurich. JACQUIN. *L'Eclairage Elec.*, Sept. 12 and 19.—A very long, illustrated description of the central station; it is driven by water-power and contains 10 low-pressure dynamos of about 125 to 150 horse-power each; in addition there is an auxiliary steam plant; the alternating-current system is used in connection with accumulators. The second portion is devoted largely to a description of the sub-station at a large auditorium in the city, where accumulators are charged by means of a Pollak rectifier; illustrations of this plant are given, together with a complete diagram of the connections. In conclusion some of the operating data for the main station is given, including a number of load diagrams; the station is said to be operating under very good conditions and is giving entire satisfaction.

Alternating-Current Lighting Stations. WAGNER. *Elek. Anz.*, Sept. 17.—A reprint of an article discussing the methods for more completely utilizing the machinery in steam-driven alternating-current lighting stations. A motor load would not be of great assistance, being limited to small motors, which would have to be very numerous; he believes that larger motors cannot compete with gas motors in the cost of power; the use of accumulators for storage is discussed; the loss in changing the current and then starting it averages about 50 per cent.; with rectifiers the efficiency may be increased about 10 per cent.; this, together with the cost of the plant, limits this method; he therefore concludes that the best method is to utilize the machinery itself by using the current for railways and for pumping the water supply of the city, the latter being the preferable method.

Electricity in Coal Mining. Lond. *Elec. Rev.*, Sept. 18.—An illustrated description of the plant in the Abercanaid Colliery in South Wales, which was installed some years ago, and resulted in considerably extending the workings; it was here found that the capital required for this plant was only one half that for a compressed-air plant, and that the latter had an efficiency of only 30 per cent., while the electric plant had 65 per cent.; during the six years running there has never been one hour's stoppage.

Railway Station Lighting. Lond. *Elec. Rev.*, Sept. 18.—A brief, illustrated description of the lighting plant at the Great Eastern Railway station in London in which a low-pressure three-wire system is used over an "area" of about 1.5 miles; a 1000-ampere-hour battery is used in connection with the plant.

Switch. *La Nature*, Sept. 5.—An illustration of a switch by means of which lights which have been left burning but are not in use can be extinguished from the generator end. The especial switch which is put in the circuit of such lights, as for instance in hotel rooms, is a sort of snap switch which is released if the current is momentarily interrupted; the interruptions are made periodically at the station end; if the light is still required the person using it must re-light it.

Rules and Regulations for Mines and Factories. MELOTTE. *Bull. l'Ass. Ing. El. Montefiore*, May 30.—A discussion of a number of the rules and regulations issued by the Belgian Government.

Protection of High-Potential Circuits Against Lightning. WURTZ. *Elec. Eng.*, Sept. 30.—An illustrated description of what he calls the pyramidal form of his lightning arrester for high-potential circuits, such as those of 10,000 or 15,000 volts; for such circuits a considerable number of choking coils and lightning arresters are required and in the present form there is considerable economy of space; in one illustration there is a total of 17 arresters, whereas by the old method 42 would be required. He states that power-transmission circuits do not require line arresters, a group of arresters installed at the two end points of the line being sufficient. He describes how a good ground connection may be made; a hole six feet square is dug directly under the arresters and deep enough so that permanently damp earth is reached; in this is filled two feet of crushed coke or charcoal, over which is placed 25 square feet of No. 16 tinned copper plate, with a No. 0 copper wire soldered across the entire surface; this is then covered with two feet of crushed coke or charcoal and filled with earth, using the running water to settle; this is found to give excellent results; to place the ground plate in a running mountain stream makes a poor ground connection; clay, even when wet; rock, sand, gravel, dry earth and pure water are not suitable materials in which to bury the ground plates; rich soil is the best; a suitable site for a lightning arrester should therefore be chosen; where permanent dampness cannot be reached water should be supplied through a pipe.

WIRES, WIRING AND CONDUITS.

Wire Insulation. NELSON. *Canadian Elec. News*, August.—He points out that while telephone and telegraph wires have been brought to a state of great efficiency, too little attention has been paid to a fair priced medium wire, as most wires are either cheap and very poor or of very high quality and price; he thinks there is a demand for a wire having about 800 to 1200 megohms per mile; some of the wires in the market do not have the qualities claimed for them. He suggests that some of the prominent engineers should make a special study of this subject; that the leading insurance companies should engage a thoroughly experienced man as a permanent inspector; that he should have a laboratory with facilities for testing all the wires; that the Government appoint this official, and that a law be passed prohibiting the use of wires of which a sample has not been officially accepted by the inspector.

Metal Supports for Overhead Lines. PIERARD. *Bull. l'Ass. Ing. El. Montefiore*, May 30.—A reprint in full of the article, an abstract of which was noticed in the *Digest*, Sept. 26.

ELECTRO-PHYSICS AND MAGNETISM.

X-Ray Experiments. ROITI. Lond. *Elec.*, Sept. 18; a translation in abstract of an article from the *Atti dei Lincei*, Vol. 292, July; and *Elettricista*, No. 9.—He shows how two tubes may be compared; experiments seem to show that cathode rays do not give rise to X-rays when they impinge on gases, but this is not true for liquids, at least not for mercury; he obtained dissociation of sulphuric acid; he ascribes an X-ray actinometer constructed on the principle of Ritchie's photometer, in which a reflecting prism is used and the light on the fluorescent screen is compared with a constant source of light, such as an incandescent lamp partly screened off with cobalt glass. He discusses the subject of cryptochrosis, which term he applies to the behavior of various forms of X-rays with regard to transmission and absorption; among other things he found that when tubes are arranged according to the penetrating power of their rays the order remains the same for different coils or voltages and the penetrating power is not in direct proportion to the power of exciting fluorescence; the introduction of a spark gap between the coil and the anode of the tube increases the penetration; when the rays have traversed any given body they acquire a different penetrative power and they penetrate more easily not only the substance traversed but any other substance; some quantitative measurements are given which show that it is impossible to give the scale of transparency of bodies for X-rays without specifying the source and the path they have traversed before reaching the body; he found that barium platino-cyanide is the best fluorescing material and that calcium tungstate is not nearly as good.

Deflection of X-Rays Behind Opaque Bodies. VILLARI. *L'Ind. Elec.*, Sept. 10; a reprint of a short Academy paper.—In studying the transparency of metals for X-rays, he placed metallic plates between the tube and an electroscope and in a number of cases observed that the electroscope was discharged even when in the shadow of the rays produced by opaque metallic screens, which led him to suppose that the rays are bent into the shadow of the opaque bodies; experiments are described to confirm this view. From this it follows that to discharge the electroscope it is not necessary that the rays should fall directly on it, as it suffices if the air through which the rays are passed be made to act on the electroscope; it is discharged by blowing air onto it which has been traversed by the rays; the rays therefore give the air the property by which they discharge the electroscope, which property the air retains for a certain time.

Tubes for Producing X-Rays. RIGHI. Lond. *Elec.*, Sept. 18; a short article similar to the one abstracted in the *Digest*, Sept. 26.—These tubes

he states cost almost nothing, and may be constructed in a few minutes. A piece of thick glass tube 15 cm long, 0.8 cm internal and 1.6 cm external diameter, is closed at one end with an aluminum thimble cemented on with sealing wax; the cathode is a small aluminum disc 7 mm in diameter introduced in the other end at 8 cm from the bottom of the tube; the thimble is immersed in water while the tube is being exhausted. Excellent results were obtained with these tubes, including an instantaneous photograph of the bones of the hand; these tubes must remain attached to the pump, as otherwise the internal pressure will increase with time and use; the exhaustion should be carried to its highest degree.

Effects of Heat and Electricity on the Transparency of Bodies Toward Röntgen Rays. Vandevyer. *La Nature*, Aug. 22.—A description of experiments in which metals were heated to a red heat; it was found that the permeability was identically the same as when they were cold. A small platinum solenoid was photographed while a current was passing through it sufficient to heat it to a red heat; no difference could be seen in the photograph and the one taken when there was no current; the same was true of magnetic bodies placed in the solenoid.

Röntgen Photograph of a Bullet in the Brain. Brissaud and Londe. *La Nature*, Sept. 5.—A report of a case in which a bullet from a revolver was shown on a radiograph of the head; although not very sharp the image was shown distinctly.

Röntgen Rays in Medical Practice. Sir Joseph Lister. Lond. *Elec. Eng.*, Sept. 18.—A reprint of his presidential address before the British Association meeting, a portion of which is devoted to Röntgen rays in medical practice, but gives nothing new.

Phosphorescent Zinc in Radiography. Henry. *L'Ind. Elec.*, Sept. 10.—An abstract of an Academy paper noticed in the *Digest*, Sept. 26, under Glow-Worm Radiations.

Electric Convection by Röntgen Rays. Righi. *L'Ind. Elec.*, Sept. 10.—An abstract of an Academy paper.

Röntgen Ray Hypothesis. Lond. *Elec. Rev.*, Sept. 18.—A short summary of the hypotheses which have been offered.

Lenard Rays. Lond. *Elec.*, Sept. 18.—A brief description of Lenard's experiments by one who has seen them.

Conductivity of Hot Gases. Pettinelli and Marolli. Lond. *Elec.*, Sept. 18; abstracted from the *Atti dei Lincei*.—They found that all gases have approximately the same resistance when heated; they begin to conduct appreciably at 600° C. and at 800 there is a sudden tenfold increase in the conductivity, after which the increase is slower; the size and substance of the cathode is important; if porous, it increases the conductivity considerably.

Electric Potentials in a Moving Liquid. Villemontee. *L'Eclairage Elec.*, Sept. 12.—The beginning of a long article on experimental researches.

Electrodynamic Theory of the Earth and of Atmospheric Perturbations. Zenger. *L'Eclairage Elec.*, Sept. 12.—A brief communication regarding his theory.

Emancipation from Scientific Materialism. Lond. *Elec. Rev.*, Sept. 18.—An abstract of a paper from *Science Progress*, Vol. 4, No. 24, referring to the recent paper of Ostwald.

Rule for Determining the Directions of Currents in an Electromagnetic Field. Zehnder. *L'Eclairage Elec.*, Sept. 12; abstracted from *Wied. Ann.*, Vol. 57, page 459.—A general rule applicable to the different cases; the description in this abstract is not quite clear.

Magnetic Behavior of Electrolytic Iron, Nickel and Cobalt. Leick. Lond. *Elec.*, Sept. 18; a translation in full of the article abstracted in the *Digest*, Sept. 17.—In addition to what was said before, it may be added that he shows two properties of thin films; the thinner they are the nearer does the ratio of their permanent magnetism and their temporary magnetism approach unity; an infinitely thin film ought to retain all its temporary magnetism and give a square top hysteresis loop; with films so thin that there is no room for eddy currents, it makes no difference to the residual magnetism whether the currents are switched off slowly or suddenly. The paper contains numerous tables of results.

Magnetometry and Archæology. Folgheraeter. Lond. *Elec.*, Sept. 18; abstracted briefly from the *Atti dei Lincei*.—He suggests that the inclination of the earth's magnetic force in bygone ages may be determined by the magnetization observed in Tuscan and other vases; during the process of firing they are slightly magnetized by the earth's field and he assumes that they were placed upright in the furnace; experiments are being made to prove this by means of experimental cones and cylinders placed in various positions in the furnace.

Magnetization of a Sphere in a Uniform Field. Grotian. *L'Eclairage Elec.*, Sept. 12; abstracted from the *Wied. Ann.*, Vol. 57, page 751.—A description of experiments which confirm the theory that a sphere will be uniformly magnetized if placed in a uniform magnetic field; the ballastic method was used.

Electrical Oscillators. Tesla system. *Elec. Rev.*, Sept. 30.—A reprint in abstract of five different patents granted to him Sept. 22 for his oscillator, which is said to be thoroughly practical and efficient; it is for the conversion of direct or alternating currents into electrical vibrations of any desired frequency (it is entirely different from the oscillator which he described some years ago, which was a sort of steam or compressed air engine producing an oscillating motion). The apparatus consists essentially of a choking coil in an ordinary continuous-current lighting circuit; also a make-and-break around which is placed a condenser in series with which is the primary of a transformer, the secondary of which is the source of high-frequency currents; by this arrangement the condenser may be made small and inexpensive; as the capacity and self-induction may be given any desired value the frequency may be adjusted at will; the apparatus may be made in a very compact form and its operation involves but a small expenditure of energy, while it involves practically no care; an interrupter is also used when the prime source is an alternating current, but in that case the interruptions must be timed with reference to the frequency of that current, and for this purpose a synchronous motor is used to operate the circuit-breaker; some of the illustrations in the patents are reproduced.

Röntgen-Ray Tube. Davies. *Elec. Eng.*, Sept. 30; reprinted from *Nature*.—An illustrated description of various forms of tubes and experiments made with them, the principal feature of which is that there is no glass vessel; the ordinary concave cathode being a nearly complete sphere of metal with the platinum anode at its centre; the experiments were made under the guidance of Prof. Lodge. They showed that both the size and the shape of the anode have an important influence; the form which gave the best results was one in which the anode plate was a flat disc only slightly smaller than the sphere; this sent a powerful radiation through three feet of solid timber and showed the bones of a hand at a distance of 30 feet; it has rubber joints and ebonite insulation, and is therefore not applicable for continuous work; in the final form the joints were made of mercury and the insulation of porcelain; with the exception of the latter piece the entire apparatus can be made in the lathe; it is possible to focus the anode.

Search for Solar X-Rays on Pikes Peak. Cajori. *Amer. Jour. of Sc.*, October.—Descriptions of some experiments made with plates suitably protected from the light and exposed at the summit of Pikes Peak, at an elevation of 14,147 feet, from June 27 to Aug. 10; on development the plate failed to show any action, there being no traces of shadows from the metallic strips; he concludes that even at high altitudes no evidence of the presence of Röntgen rays in solar radiations is obtained.

Hertz's Experiments. Perkins. *Elec. Rev.*, Sept. 30.—A reprint from the *University Scientific Magazine* giving a brief description of Hertz's experiments and an illustration of his laboratory.

Notation of Terrestrial Magnetic Quantities. Bauer. *Elec. Eng.*, Sept. 30.—A reprint (without acknowledgment) of the article noticed in the *Digest*, Sept. 12.

ELECTRO-CHEMISTRY AND BATTERIES.

Applied Electro-Chemistry. Swinburne. Lond. *Elec.*, *Elec. Rev.* and *Elec. Eng.*, Sept. 18.—A reprint of his first Cantor lecture. After calling attention to the importance and the rapid development of this industry, he discusses the question of the cost of energy obtained from coal and water-power, calling attention to errors frequently made in the estimation of the cost, and showing that the cost of water-power is generally not as low as is often thought; the location of the water-power is also of great importance; this forms the greater part of the lecture; at the end he discusses briefly the question of theory in a very elementary way, pointing out that for most purposes electrolysis is used for bringing about oxidation or reduction, which two operations also cover the largest portion of the processes used in commercial chemical manufacture; the lecture is almost entirely devoted to the industrial side of the question.

Electrolysis of Water. Sokoloff. Lond. *Elec. Eng.*, Sept. 18, and *Jour. of the Chemical Society*; abstracted briefly from the *Ann. Physik u. Chemie*.—He examines experimentally the question of the minimum E. M. F. required to produce electrolysis of water and shows the difficulties of determining it; he shows that electrolysis can be produced by any E. M. F., however small; in contradiction to Helmholtz he found that one volt suffices to produce gas of measurable pressure; at low pressures he obtained a value of 0.745 volt, which is much smaller than than that given by Helmholtz.

Electro-Deposition of Zinc. Andreoli. *L'Elec.*, Sept. 19; the conclusion of his long article (see *Digest*, Sept. 26).—He continues the summary of published experience with numerous different methods; no general conclusions are drawn.

A Gas Battery Experiment. Payson. *Elec. Rev.*, Sept. 30.—A brief description of some experiments made with a gas battery in which he used sulphuretted hydrogen as the source of energy, as he finds that this gas has features which he believes are unequaled by any other gas; the sulphuric acid is impregnated with this gas, the electrodes being carbon; with this he obtains an E. M. F. of two thirds of a volt, which may be increased if the gas is under pressure; if this pressure is high enough he thinks there is no reasonable doubt that a current could be obtained sufficient for practical purposes; for a depolarizer nitric acid or chlorine under pressure or possibly air, may be used in a porous cup; the excitation of the gas produces water, sulphurous and sulphuric acid, but

the main product seems to be water and free sulphur; he thinks there is no great difficulty in producing commercial results if the gas can be manufactured cheaply enough, as, for instance, by heating sulphur and grease; the sulphur collected from the anode cups may be used over again.

Accumulators. *West. Elec.*, Oct. 3.—An illustrated description of the BOESE and the BLOT or shuttle accumulators, the former being of German and the latter of French origin; both have been described briefly in these columns.

Anaconda Electrolytic Copper Refinery. *Elec. Eng.* and *Elec. Rev.*, Sept. 30.—A reprint of the article noticed in the *Digest*, last week.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Protecting Sensitive Galvanometers Against External Magnetic Influences. RAPS and FRANKE. *Elek. Zeit.*, Sept. 17.—The sensitive astatic mirror galvanometers may be made independent of the variations of the earth's magnetism by astatising the needles so completely that the forces of the earth's magnetism are negligibly small as compared with the torsion of the suspension fibre or the force of the directing magnet. One method of making them perfectly astatic consists in placing one or two bundles of soft iron wires in a horizontal direction near the weaker magnet and external to the case of the instrument, which increases the component of the earth's field in that direction to neutralize the component which is due to the magnets not being exactly 180 degrees from each other; it is suggested to attach to the suspended part two small auxiliary magnets, which are much lighter and weaker than the chief magnetic needles; they are so magnetized that the sum of their moments is only slightly greater than the component of the two main magnets; by turning them the system may then be completely astatised; such a system is independent of disturbances in all directions. If in a single-coil galvanometer three main magnets are used at equal distances from each other, the upper and lower being at only half the strength in the opposite direction as compared with the middle one, the instrument will also be independent of any external disturbances; by a combination of both methods a complete protection from such influences can be obtained; a description of such a construction is promised.

Standardizing an Electrometer for 18,000 Volts. JANET. *Bul. Soc. Int. des Elec.*, April.—He describes the construction of the instrument, which is a Kelvin electrostatic voltmeter, with vertical quadrants, discusses the theory of its action briefly, and describes a method for calibrating it. Two methods may be used, the first, called the indirect method, is to use a transformer whose ratio of transformation is known, and measuring the voltage of the low-tension circuit; this presupposes that the ratio of transformation remains constant, which assumption he discusses briefly, showing that it may be approximately verified; he prefers the direct method, which is the one described; in this he compares the instrument directly with the absolute electrometer of Abraham and Lemoine, which is a modification of the absolute electrometer of Kelvin, in which the force of attraction between the two discs is measured by means of a balance; as a source he used a Wimshurst machine, which was turned by means of an electric motor; its poles were connected to two discharge points, in derivation to which there was a Leyden jar, in whose circuit was placed a very poor conductor, as for instance a piece of twine saturated with paraffin; under these conditions the difference of potential remains remarkably constant and could be varied by changing the distance between the points. The curves obtained were not straight lines, but were slightly curved.

Magnetic Units. BLONDEL. *L'Eclairage Elec.*, Sept. 19.—A short article in defense of his proposed system which was recently criticised unfavorably by Hospitalier; it was claimed by the latter that the units were too complicated and too small; the author shows that the complication is only apparent and that the units are really better suited for the calculations of the engineer; he uses only three new names instead of four and avoids the confusion between $\mathfrak{B}$ and $\mathfrak{H}$. His system is as follows: M. M. F. symbol $\mathfrak{F}$, name Hertz, value 10^{-1} C. G. S. units; field intensity, $\mathfrak{H}$, Hertz per cm, 10^{-1}; flux, ϕ, Maxwell or Max, 10^{8}; induction, $\mathfrak{B}$, Maxwell per square cm, 10^{8}, and reluctance, $\mathfrak{R}$, Arago, 10^{-9}. He calculates an example by both systems, showing that this system is the simpler, and gives the results without the large number of cyphers used in the other system; he does not use the prefix mega. It is believed by eminent electricians that there is no need for new magnetic units, to which the author replies that this is the same argument that has been used by England for a century against the metric system.

Influence of Insulation Resistance and Capacity in Alternating-Current Networks on the Potential Toward the Earth. ETTINGSHAUSEN and OSSANNA. *Zeit. f. Elek.*, Sept. 15.—To indicate the insulation resistance of a three-phase network, a static voltmeter was connected successively to each of the mains, the frame of the instrument being connected to earth; for the same insulation resistance the voltage in the three cases will be about the same, but when the insulation falls the reading will in general be less for that main; it can happen, however, that the two other lines show an increased voltage toward the earth, and even that the faulty line shows a higher voltage toward the earth than one of the other two well-insulated lines; the article deals with a mathematical investigation of this subject.

Galvanometer with a Movable Coil. SACK. *Elek. Zeit.*, Sept. 17.—An illustrated article of some length discussing the principles involved in the construction of a galvanometer of the d'Arsonval type, and describing a form of this instrument constructed by Siemens & Halske, together with a set of the curves showing its properties; he states that the tests from which the curves were taken show that this is the most sensitive instrument of that type which has yet been constructed.

Dry Pile Electrometer. Lond. *Elec.*, Sept. 18.—An illustrated description of the one described in the *Digest*, Aug. 1.

Testing Department of the General Electric Company's Works. STRAUS. *Elec. Eng.*, Sept. 30; the conclusion of his article.—A plan of the testing building is given and the tests that are made are enumerated but not described, except briefly in the case of the railway motor tests; in these, two similar motors are connected to one axle by means of gears, one being run in a forward direction while the other acts as a generator, the current from which is sent into a water rheostat; the operation is then reversed to test the other motor.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Telegraph Cable Attacked by White Ants. BOUVIER. Lond. *Elec.*, Sept. 18; translated from *Compt s Rendus*, 123, No. 8, or *L'Ind. Elec.*, Sept. 10.—A description of a cable laid in Cochin China which was rendered useless in two years; it was laid in cement nearly the whole length and was covered with gutta percha and chatterton, the whole being enclosed in a lead tube; on examination he found the remains of white ants; he does not think that they bored through the lead, but that they entered at the open end or through an accidental hole; he therefore suggests fitting metal caps over the open ends, to make the joints very perfect and to saturate the fibrous material with sulphate of copper. In an editorial note several similar cases were cited, but it is suggested as preferable that the method now in use, of enclosing gutta-percha covered conductors in pipes kept full of water, should be adopted, as this system wherever it was used has proved to be a thorough success.

Official Vocabulary of Code Telegrams. Lond. *Elec.*, Sept. 18.—A translation of a circular issued by the International Bureau at Berne regarding the second edition of the official vocabulary.

Trestle Standard for the Central Telephone Exchange at Havre. DELACHANAL. *Genie Civil*, March 14; abstracted in the *Proc. Inst. Civ. Engs.*, 125, No. 3.—A description of the trestle.

MISCELLANEOUS.

Deflection of Projectiles by Electric Cables. GUILLAUME. *La Nature*, Aug. 29.—An article has been reprinted in a large number of journals, both in this country and abroad, stating that according to a Swiss journal experiments have shown that a wire through which a current passed acted like a magnet on steel projectiles and drew them out of their course; in the present article the author states that the original journal withdrew this statement in its next issue; he then points out the absurdity of the statement and discusses the possible actions of a current on a moving projectile; he shows that even if the action were powerful enough the action would be to turn the projectile so that it would tend to be perpendicular to the wire; the possible electrodynamic action is still more improbable; the ball might carry an electric charge which might act like a current, in which case there would be an attraction and repulsion according to the direction of the current; he concludes that there is a possibility of the existence of some action of a cable on a projectile, but it is very doubtful; it would not necessarily be an attraction.

Withdrawing a Needle from a Hand. CRESTIN. *La Nature*, Aug. 22.—A description of a case in which a broken end of a needle in the hand of a woman was withdrawn by means of a powerful magnet without a surgical operation and without the loss of any blood. The hand was placed near the poles of a very powerful magnet in such a position that the needle was drawn in the direction of its point; after nine treatments, lasting altogether 20 hours, the needle came out through the skin; it had been in the hand two months and as its definite location was not known a surgical operation had not been performed.

Utility of a Fire as Protection Against Lightning. *Cosmos*, Aug. 8.—There exists an old saying among peasants that when a storm is approaching a fire should be made in the stove, with as much smoke as possible. In a recent article by Schuster he shows that this custom is a rational one, as the products of combustion and the smoke act as a very effective conductor to discharge the atmosphere slowly but surely. He quotes from statistics showing that out of 1000, 6.3 churches and 8.5 mills were struck by lightning while the number of chimneys of factories was only 0.3.

Standardizing Incandescent Lamp Bases.

For the greater convenience of several of the manufacturers who have signified a desire to be present, the date of the meeting for discussing the standardization of the incandescent lamp base and socket has been changed from Thursday, Oct. 8, to Friday, Oct. 9, commencing at 10.30 a. m., at the rooms of the American Institute of Electrical Engineers Havemeyer Building, this city.

An 800-HP Railway Engine.

The John T. Noye Manufacturing Company, Buffalo, has just completed a large railway engine which has been shipped to South Bend, Ind. A description of this new machine will prove interesting.

The engine is notable for the extreme simplicity of its valve gear. It will run at 125 revolutions per minute. It is of the tandem-compound type, and will operate without a receiver at a steam pressure of 110 pounds per square inch. The cylinders are 21 inches and 38 inches respectively, and the stroke three feet. A simple form of flat gridiron valve is used. The engine will be capable of developing 1000 horsepower if forced. The fly-wheel is 12 feet 6 inches in diameter, has a 60-inch face and weighs 22,000 pounds. It is of cast iron and of four parts. An extra heavy arm is cast at the point of the break joint where the two parts of the wheel are supported. The tendency of most all wheels is to spring outward at the joint and in this regard The John T. Noye Company has made an important improvement.

The cylinders are bolted together by a yoke, as seen in Fig. 2. Here again is another point where a common difficulty has been overcome. It

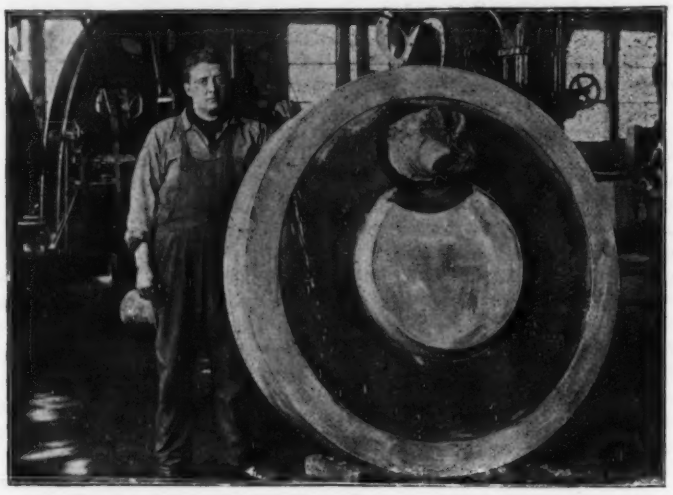


Fig. 1.—Crank-Pin and Disc.

has generally been difficult in tandem engines to remove the low-pressure cylinder head. The regular low-pressure cylinder head of the Noye engine is covered with a false head, which is split, but this is only for appearance, the principal advantage being that the yoke between the two cylinders is of sufficient opening to allow the pistons to be run clear back and the low-pressure piston head to be taken out through the side of the yoke without removing any part of the yoke or the high-pressure cylinder. This is claimed to be considerably more of an advantage than is possessed by any of the present tandem compounds. The engine will be run condensing.

The shaft, which weighs about 5½ tons, is driven by a crank pin and disc (Fig. 1). The engine has two eccentrics and a fly-wheel governor which governs only the high-pressure cylinders, the low-pressure cylinder taking the exhaust as it comes. Sight-feed oil cups are used throughout. The main bearings, which are babbitt-lined, are divided into quarters, the diameter being at 45 degrees of the horizontal. The sectors are adjusted

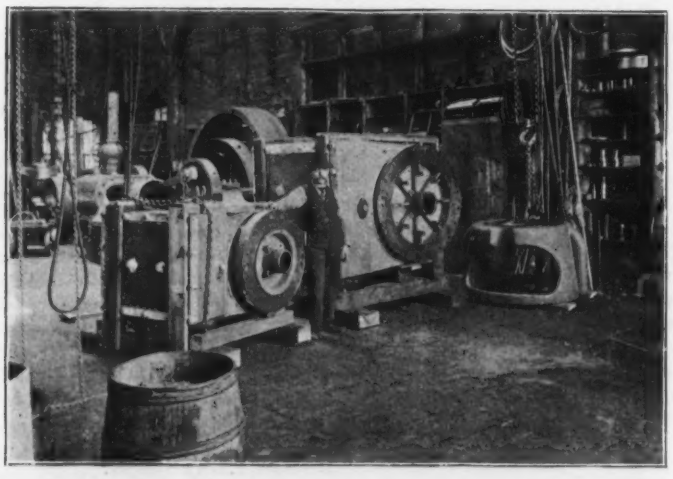


Fig. 2.—High and Low Pressure Cylinders and Yoke.

by wedges and screws. The wrist and crank pin bearings are brass-lined and adjusted by wedges. The engine complete weighs 140,000 pounds, and the makers stand ready to guarantee an economy of 18 pounds of steam per hp-hour. The packing nuts are star-shaped and can readily be tightened with a stick while the engine is running.

The simplicity of this engine enables its production at a competitive figure, and it is one which will find favor with the street railway engineer.

Motor Starting Boxes.

The tendency to specializing in the manufacture of electrical apparatus and appliances has given rise to innumerable concerns which devote their energies to the production of one, two or three classes of goods. The result of this has been to greatly improve, simplify, standardize and cheapen the various articles in an electrical installation. For the manufacturer of a few specialties in large quantities is enabled to give that attention to the minute details of each design which is necessary to produce a high degree of excellence at a low cost and goods of a uniform quality.

Among the earliest sources of difficulty was the motor starting box. The ease with which the old boxes could be left at intermediate points

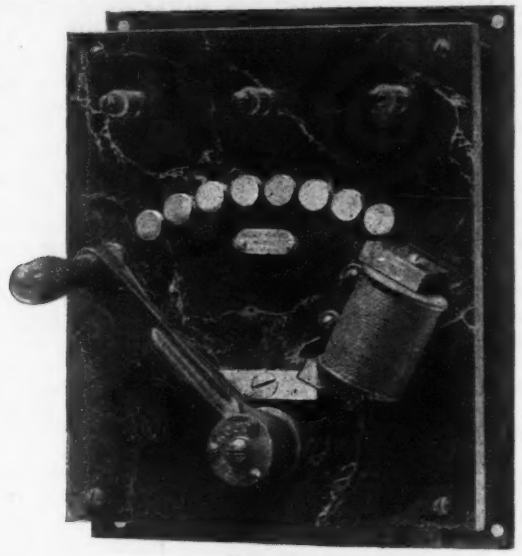


Fig. 1.

and the temptation to leave them there to regulate the speed of the motors resulted in constant burn-outs, and as the boxes were built of wood the user was lucky if the burn-out was confined to the box without the assistance of a fire engine. To avoid this fire hazard the boxes were later built of iron and slate and the lever was arranged with a spring in such a way as to prevent its being left at an intermediate point of the rheostat. It was also provided with a catch to hold the lever in position at "full on." This arrangement removed the hazard as regards the box but not as regards the motor, and frequent burn-outs of armatures were common through the inefficiency of the apparatus.

Fig. 1 shows a motor-starting device made by the Cutler-Hammer Manufacturing Company, Chicago, Ill., which, it is claimed, prevents all

Fig. 2.

of the trouble above referred to. Since the formation of the Cutler-Hammer Company 5000 of these starters have been installed.

For the protection of motors against grounds, short-circuits and lightning the device shown in Fig. 2 is claimed to be most advanced. In the event of the occurrence of either of these conditions a resistance is imme-

diately thrown into circuit, which shuts down the motor at once. It acts also when the motor becomes overloaded beyond a given point, thus making it perform the function of a magnetic cut-out.

The resistance is inserted before the circuit is opened and no arcing occurs. The calibrated scale and the overload attachment are a great convenience, as it enables the operator to both set the overload at any desired point and determine the amount of current being consumed by the motor at any time, in order to comply with the most advanced rules for motor installations, the apparatus is so arranged that not more than 50 per cent. overload can be permitted in any event.

The claim of the Cutler-Hammer Manufacturing Company for this device is that it protects the motor from all electrical hazard, including that due to open field circuit, overloading the motor, short circuits, grounds, lightning, leaving the lever at intermediate point and fire, and that it at once performs the functions of a motor-starting rheostat, with automatic magnetic release, a magnetic circuit-breaker, lightning arrester, fuse and ammeter.

The New York Fire Department, which is usually well to the front in such matters, has so changed its late rules as to compel the use, in New York, of a device furnishing this class of protection in all motor installations.

Slow-Speed Dynamos and Motors.

The accompanying illustration represents the multipolar slow-speed dynamo manufactured by the Commercial Electric Company, Indianapolis, Ind. It is constructed with the greatest simplicity possible consistent with highest efficiency and correct electrical proportions, and is adapted to be set in any position, either on the floor or suspended from the wall or ceiling, without requiring any platform.

The frame is cast steel of special composition, and the field-cores are round instead of square or oblong, which gives the smallest possible length of wire in the coils, hence the smallest loss in the fields and highest efficiency. The steel frame produces a magnet of such strength that sparking and changes of load are said to be entirely avoided, and the brushes do not require shifting to prevent sparking even though the entire load be thrown suddenly on and off.

SLOW-SPEED DYNAMO.

The armature is of the ring type, with wires on the surface where they are exposed to the cooling action of the air. The ring is open at both ends and the circulation of air through the middle of the core unobstructed, thus cooling every wire on the armature as well as the core itself.

The brushes are carbon, feed automatically and do not need to be "re-set" as they wear down.

All connections are conveniently located on the yoke that carries the bearing, so that the bearing may be taken off and armature removed if necessary without disturbing the connections and thus avoid the mistakes that occur when inexperienced persons are obliged to disconnect and connect up a machine. The type illustrated is made in all standard sizes up to 30 horse-power.

Electrical Exhibits at the American Institute Fair.

The American Institute Fair opened at Madison Square Garden, New York City, on the night of Sept. 28, and among the many exhibits are found several of an electrical nature. On the main floor of the immense building are found exhibits of several well-known electrical and kindred concerns.

Near the main entrance two cathodoscopes attract the attention of the visitor. They are located in a neatly arranged booth and are operated by Hamerschlag & Co., New York.

The New York Chemical & Electric Company, New York, has a neat and complete exhibit of a full line of battery supplies, electric bells, push buttons, fan motors, medical batteries, etc. The exhibit is very well displayed in a nicely arranged booth and attracts considerable attention.

An electrical novelty that attracts a great deal of attention is a revolving miniature Ferris wheel, the periphery of which is illuminated at night by small red, white and blue incandescent lamps. This wheel forms a part of the exhibit of the Bissell Carpet Sweeper Company. In the construction of the wheel the cars are represented by carpet sweepers. On the face, arranged concentrically with the periphery, in letters made up of red, white and blue lamps, are the words, "Bissell Carpet Sweepers." When in motion this wheel makes a very attractive display.

The Columbia Phonograph Company has an exhibit of several phonographs of different styles. It also has a phantoscope which is run by a Lundell motor. This instrument projects pictures upon a screen by means of a magic lantern.

The H. W. Johns Manufacturing Company, New York, has what it terms a "general" exhibit, which includes samples of everything the company manufactures. To be more definite, the display includes roofing material and asbestos for all purposes; the electrical department of the business is represented by displays of electrotherm heating pads, molded mica insulating materials, trolley insulating appliances, vulcabeston goods and the H. W. J. street car heaters. This company's exhibit forms one of the largest at the fair and is very artistically designed and executed.

The Outcalt Manufacturing Company, of Spotswood, N. J., manufacturer of automatic electrical scales, has on exhibition one of these devices in practical operation.

The Gold Street Car Heating Company, of New York and Chicago, has an attractive display of electric heaters for street cars, residences, etc. The heaters are of various designs and finish and are very attractive in appearance. Various forms of panel heaters are shown, and a portable electric heater for a dwelling is very artistically designed and will no doubt win the favor of the general public.

The North American Kinetoscope Company, of New York, has an exhibit of eight kinetoscopes, which attract considerable popular attention. Mr. F. R. Chinnock, who is well known in the electrical trade, is general manager of this company.

In the Machinery Hall, in the basement of the building, one of the most interesting exhibits is that of the Otto Gas Engine Works, Philadelphia, Pa. The exhibit consists of four horizontal gas engines, varying in power from 4 to 34 horse-power. Besides these there are two upright marine engines of 25 and 50 horse-power. All of these machines are handsomely finished and attract considerable attention from those interested in this class of apparatus. One of the gas engines, of 13 horse-power, drives an 8-kw C. & C. dynamo for the purpose of supplying current for five Pioneer arc lamps, used in the illumination of the exhibit, also for the incandescent lamp sign of the company, which surmounts its space. The dynamo is connected to the engine by belting. A compact switchboard, installed by A. C. Manning & Co., is provided with six circuit switches and a dynamo switch, Weston voltmeter and Whitney ammeter. The electrical features of this exhibit were installed by H. W. Tomlinson, of New York.

Julian Scholl & Co., of New York, representatives of the Weston Engine Company, Painted Post, N. Y., have one of their 120-hp horizontal engines in practical operation, the power from which is used for driving various machines which comprise other independent exhibits on the Twenty-sixth Street side of the building. The engine runs with remarkable smoothness and is a well-finished machine. It is fitted with the usual fly-wheel governor, and in every respect is one of the most modern productions from the Weston Company's shops.

The Watson-Stillman Company, New York, the well-known manufacturers of machinery tools and supplies, has an exhibit of a large line of punches of all sizes and for all purposes. The exhibit also includes a full line of hydraulic jacks of all sizes and designs. The display is well arranged.

The Manufacture of a Leather Belt.

Few mechanics and engineers who use leather belting are quite cognizant of the intricate process of its manufacture. A leather belt is as carefully made as is the most efficient dynamo or the finest machine tool, the difference being that the attention is applied in a little different way.

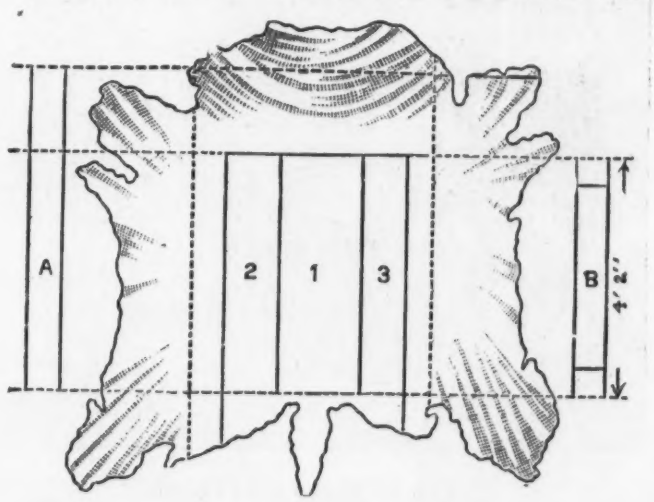


FIG. 1.—BELT CUTS.

Through the courtesy of the Chicago Belting Company, a representative of THE ELECTRICAL WORLD was permitted to take views

of the interior of its works, and these, with a description of the process of manufacture, are presented herewith.

The first step in the making of a belt is the selection of a hide and the area from which the material is to be cut. Fig. 1 shows a view of the hide. Only the choicest parts of the hides are used in the manufacture of belting. The skin which surrounds the throat and the under parts are too soft and too loose in fibre to be used for the purpose, only the sections within the dotted rectangle being of any value to the belt manufacturer. The rest is sold as scrap. For the best belts the upper

Fig. 2.—Stretching the Leather.

part of the rectangle which comprises the neck and shoulders is not used, but also is cut away and discarded. The rectangle marked "1" is the best cut and lies directly over the back bone. It is called "centre stock," rectangles 2 and 3 being called "side stock." The grain of the leather in the centre stock is distributed symmetrically, so that in building up the belt there is no possibility of uneven stretching, whereas in the side stock the grain is closer and denser toward the back bone and the belt has to be built up very carefully to be satisfactory.

The first process is to wet the hides down thoroughly and shave off the loose flesh. When properly done this just cuts in half the arteries and veins which are next the skin, and a well-shaved piece of leather will show these halves of the circulatory system of the animal upon the flesh side. The belt, still in a wet state, is then placed upon a table and thoroughly rubbed down by machinery. This rubs out all of the sand, grit and other

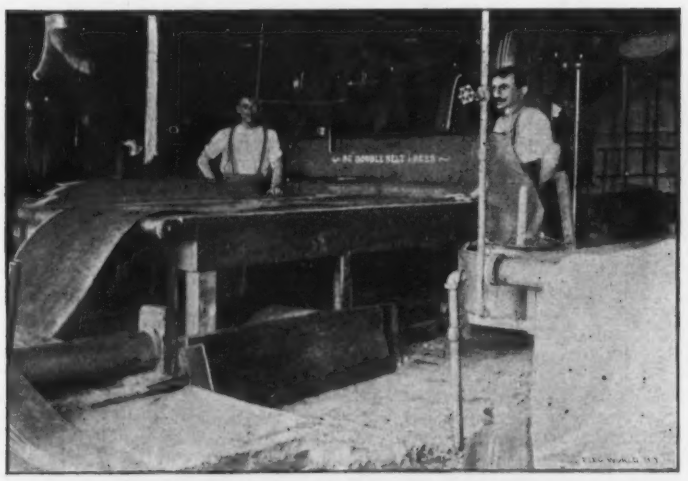


Fig. 3.—Large Belt Press.

materials that are liable to be in the leather and which would prove detrimental to the belt. The hide which is used for belting has to be carefully watched from the day that it is first bought on the animal. A scratch, such as an animal might receive from a barbed-wire fence, will heal, but the scar in the skin will remain and will cause a weak spot in the leather after it has been tanned, therefore stock whose hides are to be used for belting are very carefully selected and cared for. From a shipment of "butts"—tanned hides being called "butts"—which comes in, only those which are free from such defects are utilized.

After the hide has passed through the scouring machine it is taken to another room while still in a damp condition and is dressed on the hair side with an oil dressing and on the other side with a grease dressing, which is thoroughly rubbed in. It is then allowed to dry until the surplus stearine has a chalky consistency, when it is scraped off. The hide is then wet down and taken to the stretching room, where it is stretched between powerful clamps and allowed to dry in that manner.

Fig. 2 gives a view of the stretching room. The process of stretching, of course, results in a distortion of the heretofore rectangular pieces of leather, those with the closest fibre stretching the least. Every possible amount of stretch is taken out of the leather before it is made into belts. The stock, after stretching, passes to another room where it is assorted (Fig. 5), again trimmed into rectangular shape and the ends shaved so that they can be lapped together on a bevel joint without making a lump. Uniformity of stock is secured by selection, not by splitting. The

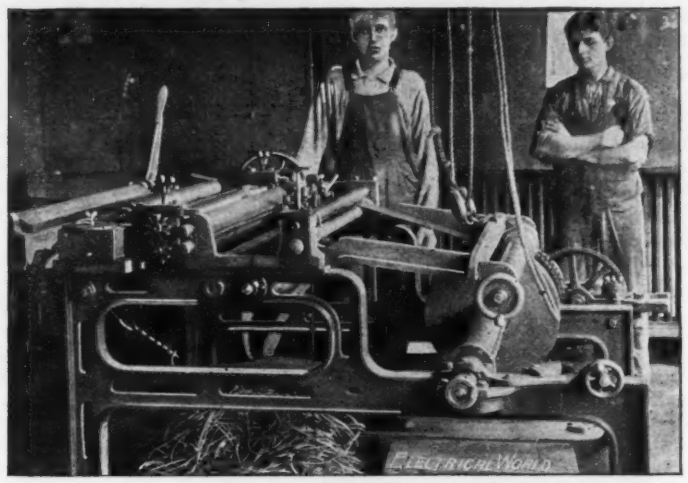


Fig. 4.—Finishing the Edges.

pieces are then carefully assorted, those of uniform thickness being placed together, and they are then ready for the belt-makers. The belt is formed up on a large table, at the end of which is a powerful hydraulic press. The joints are laid together with cement, their edges being carefully scraped and trimmed so as to be as smooth and uniform as possible. Each joint in turn is then slipped under the hydraulic press and held firmly while the next joint is being made and the cement is setting.

After leaving the presses the belt is rolled up and passed through another dressing, which darkens its color and improves its quality. After being dried it passes through a set of rolls and through cutters (Fig. 4), which shave its edges so as to make the belt uniform in width. It is then rolled up tightly, sewed up in burlap and is ready for market.

Fig. 5.—Trimming and Sorting.

Fig. 3 shows an 86-inch belt press, which is said to be the largest one in the country.

Double belting is formed in a similar manner, with the exception that it runs twice through the belt presses, and the joints are all staggered, so that every joint on one thickness is adjacent to the solid leather of the other.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, Oct. 3, 1896.

ELECTRICAL STOCKS.—There was a general decline in electrical stocks during the week, although they were merely fractional. The general market appeared to be weak. General Electric shows a net loss of ½ point on the week's trading, the number of shares sold being 7599, which is below the average. Electric Storage Battery, both common and preferred, show fractional losses, as do Westinghouse common and preferred. Edison Illuminating of New York holds steady.

TELEGRAPHS AND TELEPHONES.—Of the telephone stocks the principal change noted is in Bell Telephone, which closed the week with quotations three points lower than the close of the week previous. Erie Telephone stock was strong and closed with an advance of one point to its credit. Western Union Telegraph was dull, and closed with a fractional loss—⅝. The number of shares dealt in was below the average, being only 5788. The highest price of the week was 84½, and the lowest 83¾.

TRACTIONS.—Trade in street railway securities during the past week was very slack, little business being done. In some instances higher prices are asked, and in others declines are recorded.

BROOKLYN HEIGHTS RAILROAD EARNINGS.—The gross earnings of the Brooklyn Heights Railroad for the fiscal year 1896 were $4,272,302, an increase of $220,203 over the preceding year. The net earnings were $1,769,166, an increase of $576,783. Nearly $900,000 was expended in additions and betterments during the year.

GRAND HAVEN, MICH.—Sealed proposals will be received by W. N. Angel, City Clerk, until 4 o'clock p. m. Oct. 14, for the purchase of $10,000 of 5 per cent. electric light coupon bonds; a deposit 2 per cent. of amount of bond bid must accompany each bid.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked
Chicago Edison Company	100	..	..
Edison Electric Ill., New York	100	93	95
" " " Brooklyn	100	88	93
" " " Boston	100	..	..
" " " Philadelphia	100	..	..
Edison Ore Milling	100	7½	10
Electric Storage Co., Philadelphia	100	29	29¾
Electric Storage, pref	100	31¼	32
General Electric	100	28¼	28½
General Electric, pref	100	64	67
Westinghouse Consolidated, com	50	23	23½
" " pref	50	49½	50
BONDS.			
Edison Electric Ill., New York	105	95⅝	100
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	88½	..
TELEGRAPH AND TELEPHONE.			
American Bell Telephone	100	204	205
American District Telegraph	100	*29	39
American Telegraph & Cable	100	90	91½
Central & South American Telegraph	100	124	127
Commercial Cables	100	140	..
Erie Telephone	100	58	58¾
New England Telephone	100	90	..
Postal Telegraph-Cable	100	78	80
Western Union Telegraph	100	83½	83⅝
ELECTRIC TRACTION STOCKS.			
Baltimore Traction	25	16⅝	16⅞
Brooklyn Rapid Transit		19½	21½
Brooklyn Traction	100	..	14
" " pref	100	46	48
Buffalo St. Ry	100	65	68
Cleveland Electric Ry	100	..	..
Columbus St. Ry	100	41	43
Hestonville	100	48	48½
" pref		..	62½
New Orleans Traction	100	5	9
" " pref	100	45	55
North Shore Traction	100	22	25
" " pref	100	72	75
Rochester St. Ry	..	15	17
Steinway Ry	..	45	50
Union Railway (Huckleberry)		96	103
Union Traction, rcts $10 pd	..	12¾	13
West End, Boston	100	67	70
" " pref	100	89½	90
Worcester Traction	100	14	17
" " pref	100	85	89
BONDS.			
Brooklyn Rapid Transit 5s. 1945	100	76	..
Buffalo St. Ry. 1st con. 5s	100	..	*104
Cleveland Elec. Ry. 1st mtge 5s	100	100	*103
*Columbus St. Ry. 1st 5s	100	90	*95
Rochester St. Ry. 1st 5s	100	..	98
Union Railway (Huckleberry) 1st mtge 5s		101	*103
*Westchester Electric 1st mtge 5s	100	100	103

* With accrued interest.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, Oct. 5, 1896.

DEATH OF MRS. F. R. COLVIN.—Fanny A. Colvin, wife of Mr. F. R. Colvin, who is well known in the electrical trade, died on Sept. 28. Mr. Colvin's many friends will sincerely sympathize with him in his bereavement.

FOR SALE.—The plant of the Electric Power Company at St. George, S. I., is advertised for sale by the referee, George A. Greenfield. The sale will take place on Oct. 31, and it is thought that the plant will be purchased by the Richmond County Electric Company. A foreclosure suit has been brought by the bondholders, representing $36,000.

NEW TELEPHONE COMPANY.—The Ericsson Telephone Company, 256 Broadway, has completed arrangements to enter the field with the Ericsson telephone, a Swedish instrument, the main feature of which is the microphone. The company will manufacture the Ericsson microphone and use it in combination with its own telephone. It will handle all classes of telephones. The Ericsson microphone is remarkable for its sensitiveness and reliability.

MR. J. L. SOMOFF has severed his relations with the Standard Electric Lamp & Novelty Company, this city, and established a business of his own at 534 Linwood Street, Brooklyn. Mr. Somoff has a very complete plant for the manufacture of miniature incandescent electric lamps, Crookes tubes and induction coils, and his outfit includes the very best measuring instruments, such as Wheatstone bridges, photometers, etc.

SUIT AGAINST THE FRENCH CABLE COMPANY.—Mr. Hectro de Castro some time ago brought suit in the United States Circuit Court against the French Cable Company for $53,000, which he claimed was due him for services in connection with securing cable rights in West Virginia and other places. On Sept. 30 Judge Lacombe dismissed the suit on the ground that the French Cable Company was a foreign corporation not doing business in this State.

MR. PERCIVAL ROBERT MOSES, formerly connected with the Sprague Electric Elevator Company, has opened an office in the Equitable Building, at 120 Broadway, as consulting electrical engineer and contractor, taking as specialties the installation of electric elevators and electric plants in buildings. Mr. Moses is a graduate of the Electrical Course of the Columbia College School of Mines, and since his graduation has devoted himself entirely to the subject of electric elevators, and should be competent to deal with the problems presented in this line.

HENRY ELECTRICAL SOCIETY.—The first lecture of the season will be delivered at the rooms of the American Institute, 111-115 West Thirty-eighth Street, on Friday evening, Oct. 9, at 8 p. m., by Mr. G. F. Sever, entitled "The Development of Electric Railway Practice." The society has decided to give public lectures every second Friday throughout the season, reserving the intervening Friday for class work by the members only. This season the class, under the direction of W. H. Freedman, will study "Electric Lighting" as outlined in Prof. Crocker's new treatise on the subject, which has been adopted as the text-book to be followed.

TROLLEY ON THE KINGSBRIDGE EXTENSION.—The State Railroad Commissioners at Albany have granted permission to the Third Avenue Railway Company to equip its Kingsbridge extension with the overhead trolley system, the permission being for 10 years. This extension taps the Third Avenue cable road at 162d Street and runs to Kingsbridge. Considerable opposition was made by the Metropolitan Traction Company and the Union Railway Company to the granting of this permission. The extension will be of great benefit to the residents of Kingsbridge, and will give them an additional means of reaching the city.

TELEPHONE PLANT DESTROYED BY FIRE.—The Greenpoint plant of the New York & New Jersey Telephone Company, at 157 Greene Street, Brooklyn, was entirely destroyed by fire on the night of Sept. 30. The exchange was on the fourth floor of a brick building. The night operator discovered the fire at 2.30 a. m., and vainly endeavored to extinguish it. During the fire two firemen were seriously injured, one of whom subsequently died. The loss of the telephone company is placed at $30,000, and Superintendent E. W. Carritt states that it is his belief that the fire was started by one of the telephone wires becoming crossed with a trolley wire somewhere.

PROTEST FROM THE EDISON ELECTRIC COMPANY.—The question of raising the grade of Elm Street between Pearl and Duane Streets, came up before the Board of Street Opening at the Mayor's office a few days ago. Mr. R. R Bowker, of the Edison Electric Illuminating Company, entered an objection to carrying on the proposed improvement on the ground that it would seriously interfere with the Edison's Company's plant at the corner of Elm and Duane Streets. The proposition was to raise the grade of the street about eight feet. Mr. Bowker said that to raise it more than four feet would be an injury to his plant and his company would have to hold the city authorities responsible if the eight-foot proposition was adhered to and carried out. The question was finally referred to the commission having the widening of Elm Street under consideration.

Buffalo and Western New York Notes.

BUFFALO, N. Y., Oct. 2, 1896.

MANAGER McKENZIE RESIGNS.—Ross McKenzie, who for some time past has officiated as manager of the Niagara Falls Park & River Electric Railway, on the Canadian side of the river, has tendered his resignation, to take effect Oct. 1. Mr. McKenzie expects to take another position. He has made many friends here. It is rumored that Wilfred Phillips, now electrical engineer of the road, may succeed him.

TWO ELECTRIC POWER PLANTS.—It will not be long before there will be two great electrical power plants in operation in Niagara Falls. Wallace C. Johnson, engineer of the Niagara Falls Hydraulic Power & Manufacturing Company, says that the electrical machinery is now nearly all in place in the power-station in the gorge, and that it would be started up in a short time. The starting of this second plant will mark an epoch in the history of Niagara Falls, and give a decided impetus to business in general.

ACCIDENT AT ALUMINUM WORKS.—At the Pittsburg Reduction Company's plant, where aluminum is manufactured, an accident occurred a few days ago that came near being attended with fatal results. One of the employees says that the accident was caused by the short-circuiting of a generator. The effect was to throw out bricks and pieces of iron, which riddled all the windows at the rear end of the building in which the machine was situated. Several men who were at work near the machine escaped unhurt, but were frightened. Another employee said the accident was caused by the breaking of a brush-holder. The machinery was repaired in a short time and the mill started again. The damage to the building was soon repaired.

ELECTRIC POWER IN TONAWANDA.—The Tonawanda City Council Committee, which was appointed to negotiate with the Niagara Falls Power Company, completed their negotiations Saturday, Sept. 26, and Tonawanda has obtained by the firm stand which its commissioners took all it asked for. Owing to the company's agreement with the Buffalo Street Railway to supply it with electric power by Nov. 1, the village demands were probably more readily acceded to by the power company. Attorney Hill, of Buffalo, the company's legal adviser, and other members of the power company, met for the final consultation with the village committee on Saturday. The result was that the company has at last received a franchise through Tonawanda and all the necessary rights and privileges. In return it agrees to release the village from any damages that may result from accidents occurring during the construction or operation of the transmission line. The company also agreed to furnish, upon application, not less than 250 electrical horse-power. This is of great importance, as it was thought the company would not construct a transformer in Tonawanda unless 2500 electrical horse-power was subscribed for by manufacturers, and was the important point in the contention. Another clause in the agreement states that the prices charged for the electrical power shall not exceed 92½ per cent. of the average price charged by the company or its assigns for the power in other places. This gives Tonawanda a cheaper power than Buffalo or Niagara Falls will obtain by 7½ per cent. Besides, the company agreed not to make any discrimination in prices to consumers whose factories or workshops are within Tonawanda's city line. This will give Martinsville and other suburbs the same prices as Tonawanda will pay. The company is compelled to deposit a check for $25,000 with the village clerk as a penal bond that it will observe all the provisions and conditions agreed upon in order to obtain the franchise. There are many other important conditions contained in the franchise, such as the compulsory painting of the poles once every three years, and regulations regarding the height of wires. With such an agreement Tonawanda has a great advantage over other places.

New England Notes.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, MASS., Oct. 2, 1896.

MR. GEORGE F. PORTER, secretary of the National Electric Light Association, was a Boston visitor this week.

THE BALL-BEARING COMPANY, Boston, has removed to its old quarters on Watson Street, where it has ample room to take care of its rapidly increasing business, which Manager H. A. Richmond reports as exceeding his most sanguine expectations.

THE ANCHOR ELECTRIC COMPANY, Boston, has recently issued a neat little pocket pamphlet of interest to architects and electrical engineers, in which the merits and value of its excellent variety of Anchor switches are briefly presented, and which has already attracted considerable business.

OUTPUT OF TELEPHONES.—The instrument statement of the Bell Telephone Company for the month ending Sept. 20 shows a gross output of 12,042; returned, 7,030, leaving a net output of 5,012. Compared with the same period of last year it shows a decrease in net output of 7,647. At that time the gross output was 18,318 and the instruments returned numbered 5,659, leaving a net output of 12,659.

THE ZIEGLER ELECTRIC COMPANY, 141 Franklin Street, Boston, has just issued a handsome catalogue of about 200 pages, illustrative of some of the electrical apparatus and appliances which it manufactures and sells. This prosperous and growing concern is well known for the excellent quality of the work which it turns out, and the information contained in its attractive catalogue will no doubt bring them many new customers.

THE CROWN WOVEN-WIRE BRUSH COMPANY, Salem, Mass., reports an increased demand for its excellent and now well known woven-wire brushes, and Manager Burke and Treasurer Ryder are correspondingly happy, not alone because of present good business, but as well over the indications that it will continue through the Fall and Winter. Manager Burke has just returned from a very successful two-weeks' Western trip.

THE ROBINSON RADIAL CAR-TRUCK COMPANY and the Robinson Electric Truck & Supply Company have removed from their old quarters at 620 Atlantic Avenue to the elegant offices 81-82 in the new Devonshire Building, located on Washington, State and Devonshire Streets, Boston, where they will always be glad to welcome their friends and all parties who wish to examine and investigate the radial truck. Mr. Robinson is at present developing several new and very important electric railway inventions, which will be brought to the attention of the public in due time.

THE COLUMBIA ELECTRIC COMPANY, Worcester, Mass., which has hitherto been a partnership between John P. Coghlin and F. E. Gilbert, has recently been organized into a corporation with a capital of $10,000. Charles W. Gilbert, president; F. E. Gilbert, treasurer, and John P. Coghlin, general manager. Starting in 1892, the company has always enjoyed a nice business, and can refer with pride to many handsome electrical plants it has constructed in Worcester and Central Massachusetts. Its sale of electrical supplies, of which it always carries a varied and attractive stock, has also been a source of satisfactory revenue.

MESSRS. W. D. HOFFMAN & CO., electrical engineers and contractors, Boston, have just installed in the Massachusetts Charitable Mechanics' Association Building, that city, a Dick & Church engine (of which they are New England agents), of 125 horse-power, which will be first used in connection with the World's Food Fair, opening Oct. 5. The engine is specially built for carrying 150 pounds pressure, so that it may be run from the same boiler pressure as is used on the compound engines in the present plant. The engine is direct-connected to a Siemens & Halske generator. They have also taken the entire contract for furnishing the steam piping, foundations, etc. The plant is to be a model one in every respect. Messrs. Hoffman & Co. are also New England agents for the Slater Engine Company, and report among recent sales a pair of 28 x 48 Slater engines to the Rumford Falls Paper Company, Rumford Falls, Me. The engines will drive the entire system of paper machines and will develop 1200 horse-power.

ELECTRIC POTENTIAL.—On Saturday, Sept. 26, the members of this now thriving organization enjoyed a day's outing and excursion to Nantasket Beach, *via* the electrically equipped "Third Rail" branch of the New York, New Haven & Hartford Railroad Company from Weymouth Junction, the trip over which being a courtesy kindly accorded by Col. N. H. Heft, chief of the electrical department of the company and Superintendent J. H. French. A description of the "Third Rail" system appeared in THE ELECTRICAL WORLD of July 4, hence only brief reference and the important events of the trip are mentioned. The members responded to the number of 42, and left Boston in a special car at 10.44 o'clock, being joined at Nantasket by some members from Providence, R. I. At Weymouth a high-speed open electric car was in waiting. This car had a seating capacity of 80 and is capable of a speed of over 70 miles per hour. Its alarm whistle is operated by condensed air, as are also its brakes. The section of the road over which the "Third Rail" has replaced the trolley extends from Weymouth Junction to the power-house—a distance of five and a half miles. The third rail is midway between, but about one inch higher than the regular rails. The contact is by means of a shoe having a face of five inches, the face of the third rail being about two inches. At grade-crossings and switches the third rail is removed to prevent the possibility of accidents, the car "floating" over the space by its own momentum. Tests for efficiency have shown a loss of but 60 volts between Weymouth and the power-house, the current being 500 amperes at 500 volts. Leaving Weymouth, a visit was made to the power-house, where many interesting details were explained by Messrs. Heft, Lewis and French. Reembarking a rapid run was made to Pemberton, then back to the Ocean House at Nantasket, where the party partook of a fish dinner, at the conclusion of which the Potential tendered a hearty vote of thanks to the officials of the New York, New Haven & Hartford Railroad Company, through whose kindness the trip had been made extremely interesting and instructive. It had been intended to visit the car-house, but this feature was omitted for lack of time. During the run from Pemberton to Nantasket the average speed was 60 miles per hour, although at times it ran as high as 72 miles per hour. Notwithstanding this high rate of speed there was remarkable freedom from the vibratory motion and ceaselesss pounding so noticeable on steam roads; this feature was the subject of frequent comment, and the officials of the road say that it has been constantly remarked by passengers ever since the road went into operation. The outing was an enjoyable one in every respect, and President Frank Ridlon and Treasurer I. H. Farnham have still another reason for congratulating themselves that their efforts to make this organization attractive and interesting are meeting with continued success.

Western Notes.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, ILL., Oct. 1, 1896.

RECEIVER APPOINTED.—The Warwick Electric Manufacturing Company, Cleveland, O., is stated to have gone into the hands of a receiver.

SUIT BY THE GENERAL ELECTRIC COMPANY.—Henry C. Spear, a banker of Chicago, has been served with a notice of an assumpsit suit by the General Electric Company, for the recovery of $25,600, on a note which was given to President C. A. Coffin, of the General Electric Company, in October, 1892, secured by 1000 shares of Topeka Railway stock, which was deposited as collateral.

SKY-SCRAPERS.—The Silversmiths' and the Stewart Buildings are Chicago's two latest additions to its long list of towering office buildings. The Electric Appliance Company is particularly interested in their construction, as they are to be tubed throughout with Armorite iron-armored interior conduit, sold by the Electric Appliance Company, who claims that these two buildings, when completed, will have the finest interior conduit system in Chicago.

UNDERGROUND WIRES IN CLEVELAND.—During the past 18 months considerable underground work has been done in Cleveland. In a recent report of City Electrician Hoag, he shows that 202,326 feet of underground ducts, 87,717 feet of underground cable and 12,430,549 feet of underground conduits have been laid. These improvements have been made mainly in the business sections of the city, including some of the districts on the West Side. During that period 345 poles and 4,053,920 feet of aerial wire have been removed.

CANADIAN NOTES.

MONTREAL, CAN., Oct. 2, 1896.

SUSSEX, N. B.—The Sussex Water & Electric Light Company has been organized here.

NIAGARA FALLS, ONT.—A Toronto syndicate proposes purchasing the street railway charter here, and will convert the road into an electric line.

OTTAWA, ONT.—Incorporation is asked for the Canadian Electric Light & Power Company, which proposes to build an electric railway from Coburg, *via* Port Hope, Toronto and Hamilton, to Suspension Bridge, with branch lines.

REVELSTOKE, B. C.—The Revelstoke Water Works, Light & Power Company will seek incorporation at the next session of the Provincial Legislature. Messrs. W. Cowan, J. Abrahamson, W. M. Brown and T. Downs being the promoters.

TORONTO JUNCTION, ONT.—Joseph Barrett has made a proposition to take over the lighting plant, and furnish light to the town. In connection therewith there is a project to erect a large factory at the corner of Keele and Vine Streets.

PETERBOROUGH, ONT.—Mr. J. M. Campbell, of Kingston, is preparing plans and specifications for the station and plant for the Auburn Light & Power Company. The Council has under consideration the installation of a plant for electric street lighting.

QUEBEC, QUE.—The adjourned meeting of the Quebec Street Railway Construction Company will be held on Thursday, when the provisional directors will be elected. It has been decided to close the subscription books. The main line from Lower Town to St. Roch's will be started immediately, and it is expected this part of the line will be completed this Autumn.

MONTREAL, QUE.—The town of Maisonneuve in October, 1891, contracted with the Royal Electric Light Company to furnish all the plant and appliances necessary for an electric light service for the municipality, for the sum of $9300. The company was stopped, first by an injunction after beginning the work, and when the injunction had been quashed by the courts force was used to stop the employees of the company from working. The main contention was that the contract which had been given was not within the charter powers of the town to grant. Judge Pagnuelo recently held the contrary view and found for the company, giving it judgment for $4861, with interest and costs, against the town.

MONTREAL, QUE.—According to the promise of the managing director of the Montreal Street Railway Company, that work would be commenced on the Centre Street and Côte des Neiges road route after the close the exhibition, a start was made. A gang of about 20 men were set to work on Guy Street, starting from St. James. If the line is to be completed before Dec. 1, the company will have to increase its force of laborers considerably, as the Council does not appear disposed to stand any more dilly-dallying in the matter. The Park & Island Railway Company is making rapid progress in the construction of the extension to Lachine, and it is expected to have the line through before the snow falls. The track between the city limits and Rockfield is about laid, and the grading is completed as far as the Dominion Bridge Works. The line to St. Laurent is now open and running. The work on the new power houses located at Lachine and St. Laurent is progressing, and it is expected that both will be ready to turn power on this Autumn.

General News.

TELEGRAPH AND TELEPHONE.

SUPERIOR, WIS.—The Duluth Telephone Company is taking steps to form a new company and get another franchise in Superior.

GALESBURG, ILL.—The Central Union Telephone Company expects to establish long-distance connections with New York in a few days.

RICHLAND CENTRE, WIS.—The Richland County Telephone Company has been granted a franchise to build lines and establish an exchange in this place.

PETERSBURG, O.—A telephone exchange is to be established in this place. This improvement is something that has been desired by the business community for years.

INDIANAPOLIS, IND.—The Central Union Telephone Company has purchased a piece of property on West Ohio Street, and will as soon as possible remodel the building for a telephone exchange. The company will make extensive improvements.

TOPEKA, KANS.—The Topeka-Harrison telephone plant in this city has been sold by the sheriff, the Missouri & Kansas Telephone Company being the purchaser. The plant originally cost over $32,000 and was sold for $8,000. It had never paid a dividend.

NASHVILLE, TENN.—The Southern Bell Telephone Company is engaged in rebuilding its lines in this city and will expend at least $30,000 on the work. The central office is to be reconstructed; and provision will be made for the addition of the long-distance service.

MARION, IND.—The Marion Telephone Company, a local enterprise, is establishing a telephone system in this place and expects to have it in operation in a few days. It is stated that it will start with 500 subscribers, and its rates will be $2.50 a month for business purposes, and $2 for residences.

FORT SMITH, ARK.—The Harrison Telephone Company, of this place, owned by the Harrison International Telephone Construction Company, has been sold out to the Southwestern Telegraph & Telephone Company. The Harrison exchange was built in a most thorough manner, and cost about $26,000.

ELECTRIC LIGHT AND POWER.

MADISON, WIS.—The City Council has voted against the report of the committee favoring a municipal electric light plant in this city.

CHESTER, PA.—It is reported that the Beacon Electric Company has leased the plant and franchise of the Chester Electric Light & Power Company.

NEW RICHMOND, WIS.—The New Richmond Electric Light & Power Company is desirous of receiving offers of a second-hand Ideal compound engine in perfect condition.

MANCHESTER, O.—Bids will be received in October for the purchase of $30,000 light and water bonds. Bids will be received for the water and light plant as soon as the bonds are sold.

MT. PLEASANT, IA.—At a special election on Sept. 28, a proposition to establish a municipal electric light plant was defeated. The fight between the contending parties, it is stated, was bitter.

FERNANDINA, FLA.—The Committee on Electric Lighting is in the market for an engine to run an arc dynamo for 40,800 candle-power and incandescent dynamo for 500 thirty-two candle-power and 500 sixteen candle-power lights.

PORT RICHMOND, S. I., N. Y.—The Town Board of Southfield has established a lighting district outside the village of Edgewater and street lights will be erected in Garretsons, Grant City, New Dorp, Richmond and the adjacent streets.

MUSCATINE, IA.—The Muscatine Electric Light & Railway Company has purchased the plant, good will and business of the Home Electric Light Company. The two concerns will be operated under one management and large improvements in the plant will be made.

NEW YORK, N. Y.—The sum of $30,000 has been appropriated for a complete electric light plant for the Seventh Regiment's new armory in this city, and $25,000 to complete and furnish the Ninth Regiment armory. The latter will be wired throughout with "Kerite" wire.

GRAND HAVEN, MICH.—Sealed proposals will be received by the Hon R. K. Stallings, Mayor, until 7.30 o'clock p. m. Oct. 14, for the furnishing of engine and electric lighting apparatus for the city. Copies of specifications can be obained from H. H. Humphrey, engineer, Detroit, Mich.

CLARKSVILLE, TENN.—The Clarksville Electric Light Company made an assignment on Sept. 24, with liabilities of $50,000 and assets of $8000. Mr. H. C. Stacker, secretary of the company, was made assignee and was directed to wind up the company's affairs by public or private sale within 90 days.

PHILADELPHIA, PA.—At a meeting of the Philadelphia Board of Highway Supervisors a few days ago, a permit was granted to the Pennsylvania Light, Heat & Power Company to construct a subway under Sansom Street, between Ninth and Sixteenth Streets, according to the modified plans submitted to the Board. The subway will be 4 feet wide on the outside, and a little more than 8 feet high inside. It will be built 13 feet beneath the surface of the street. The electric wires will be carried in the upper part.

THE ELECTRIC RAILWAY.

GREENSBURG, PA.—The report has been revived that an electric railway will be built between this place and Mt. Pleasant.

ATLANTA, GA.—There is a movement on foot to build an extensive electric railway from Atlanta to several of the smaller cities in the State.

ALBANY, N. Y.—The Albany Railway Company contemplates the erection of an addition to its power-house on South Pearl Street. A new generator will be purchased.

DE LAND, FLA.—The De Land City Council has granted to F. E. Band and associates a franchise for the construction of an electric railway on the streets of the town.

SUPERIOR, WIS.—R. E. McDonald, promotor of the electric road between St. Paul and Superior, has petitioned to the St. Paul Council for a franchise to build the line in St. Paul.

KINGSTON, N. Y.—The Colonial City Traction Company has made application to the Common Council for consent to construct, maintain, use and operate a branch of its electric street road in the city.

MEADVILLE, PA.—Preparations are being made to begin the work of building an electric street railway in Meadville. The question of power for the line to Saegertown, Venango, Cambridge and Edinboro will be decided shortly.

ROME, N. Y.—The City Council has approved the measure compelling the Rome Traction Company to entirely abolish horse traction and substitute electric traction therefor, on its entire system, the transformation to be completed within four years.

BALTIMORE, MD.—The Central Railway Company is having specifications prepared for the construction of the new line on Wolfe and other streets in East Baltimore, and as soon as completed they will be submitted to contractors to make bids for the work.

BRISTOL, PA.—It is stated that a new trolley railway is soon to be built from the Delaware River end of Mill Street, Bristol, through the town to Emilie, where it will strike the Newportville and Trenton road to Falsington, thence to Morrisville and Trenton.

ROCHESTER, N. Y.—It is rumored that a company is being formed for the purpose of building a trolley line from Rochester to Fairport. It is stated that plans for the new road have already been submitted and the right of way obtained. The company is to be known as the Rochester & Fairport Railway Company, and work will be begun as soon as Spring opens.

FITCHBURG, MASS.—Hon. F. S. Coolidge, of this city, and James A. Stiles, of Gardner, Mass., are interested in a project to build an electric railway between here and Gardner. At a preliminary meeting applications for franchises were authorized. It is stated that construction work will be commenced as soon as possible after the franchises have been secured.

BALTIMORE, MD.—A plan is being considered by persons interested looking to the extension of two railroads to Belair, Md. It is proposed to build the Stewartstown Railway to Belair, and extend, as well, the York Southern from South Delta, Pa., to the same city. From Belair a new line will, it said, be built to Magnolia station on the Philadelphia, Wilmington & Baltimore Railway.

NEW ORLEANS, LA.—The New Orleans & Western Railway Company has contracted with the General Electric Company for a complete electric haulage system for handling cotton at the new port—Chalmette terminal. The installation is on the overhead trolley system and will include six electric locomotives of three-foot gauge. They will supplant compressed air locomotives.

ATLANTA, GA.—Mr. H. M. Atkinson, president of the Georgia Electric Light Company, was indicted by the Grand Jury on Sept. 25 for misdemeanor. Mr. Atkinson is charged with having violated the Sabbath day, by allowing coal to be hauled on that day contrary to the laws of the State. The accusation was brought by Mr. Tyler, who Mr. Atkinson claims is taking this method of seeking revenge for his company's refusal to acquiesce in certain requests made by Mr. Tyler. The charge appears to relate to the operation of the electric plant.

Personal Note.

MR. H. T. BARNETT, of the Electric Power Storage Company, of London, England, has just come over to "the States" for the purpose of placing the Faure-King storage battery patents, on behalf of Mr. Courtenay, managing director of the Electric Power Storage Company. Mr. Barnett's address is Room 30, No. 39 Cortlandt Street, New York.

Trade and Industrial Notes.

THE KESTER ELECTRIC MANUFACTURING COMPANY, manufacturer of dry batteries and electrical specialties. Buffalo, N. Y., reports having had more business for the months of August and September than at any time during its experience in business.

INSULATING WASHERS AND BUSHINGS.—If you want a washer or bushing that will be a perfect insulator, and will answer for any kind of work, write A. O. Schoonmaker, 158 William Street, New York, for a sample and quotation of his mica washers; he is prepared to furnish to any size or thickness.

CROOKES TUBES FOR RÖNTGEN RAYS.—The New York & Ohio Company, manufacturer of Packard incandescent lamps, Warren, O., has issued a circular of Crookes tubes for Röntgen rays. Three forms of tubes are illustrated and briefly described, and various testimonials are given from users of this apparatus.

FRED. M. LOCKE, manufacturer of triple petticoat insulators, Victor, N. Y., reports having just sold three car loads of his goods for the Pacific Coast and that the outlook for the Fall trade is very promising. Mr. Locke has developed a new china insulator for street railway purposes which is claimed to be very strong, and to be superior to anything yet introduced.

McINTOSH & SEYMOUR.—One of the busiest concerns in the country at the present time is the works of McIntosh & Seymour, Auburn, N. Y., manufacturers of the well-known engine. They are working day and night to enable them to fill their contracts, of which they have several large ones. In view of the general trade depression this activity speaks well for their machines.

BALL ENGINES.—As an indication of returning prosperity, we learn that the works of the Ball Engine Company, Erie, Pa., have, on account of recent orders, more work ahead than at any time since 1892, and are running overtime with a full force. The company reports a growing demand and considerable inquiry from foreign countries, and several late orders are from these sources.

WESTINGHOUSE GAS ENGINES.—The Westinghouse Machine Company, Pittsburg, Pa., in an attractive catalogue just issued describes and illustrates the gas engines manufactured by this company. The subject matter is preceded with a brief history of the gas engine which will be found particularly interesting to those engaged in this industry. The well-known steam engines manufactured by this company are also briefly described and illustrated in the same pamphlet.

THE BOSSERT ELECTRIC CONSTRUCTION COMPANY is the title of a new concern in Utica, N. Y., incorporated under the State laws of New York. The capitalization of this company is $16,000, all of which is paid in. The officers are: President, Wm. F. Bossert; vice-president, H. P. Crouse, who is one of the most prominent business men in Utica; Secretary and Treasurer, Seth C. Adams, a lawyer by profession. The company occupies the building 40 Broadway, Utica, which has been modified and equipped with special machinery for the manufacture of panel boards, terminal boards and steel drawn wall ceiling and switch boxes.

THE AUERBACH-WOOLVERTON ELECTRIC COMPANY, Hoboken, N. J., has adopted a unique method to introduce its new alternating arc lamp. This is nothing less than offering 500 of its new fresh stock of lamps at the actual cost of manufacture. The purchaser at least has the assurance that this is no bankrupt or receiver's sale, for a visit to the company's shops recently by one of our representatives showed the greatest activity in every department. Rows and rows of lamps completely filling the extensive warerooms attests the company's confidence in the success of the lamps as a selling article. "What we want," said Mr. Auerbach, "is to have the stations give our lamps a trial. I am confident that the lamps will do the rest."

CATALOGUE OF RÖNTGEN-RAY APPARATUS.—The Edison Decorative & Miniature Lamp Department (General Electric Company), Harrison, N. J., has just issued a catalogue of Röntgen-ray apparatus manufactured by that concern. It describes quite fully the different devices used in a complete Röntgen ray outfit and illustrates the same with several well-executed cuts. The various forms of outfits and tubes are particularly well set forth for the information of the interested reader. All the exciting apparatus is made under the personal direction of Prof. Elihu Thomson, and the vacuum tubes are made at the lamp works of the General Electric Company. The catalogue is issued at a time when it will meet with a great demand, and probably largely extend the sale of the apparatus. It is gotten up in a complete and artistic manner, and the information contained therein is of general interest.

Business Notices.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 67–71 Park Place, New York.

BATTERY CUT-OUT CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, 105 South Warren Street, Syracuse, N. Y.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED SEPT. 29, 1896.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

568,335. SIGNAL BOX; C. W. Cornell, East Orange, N. J. App. filed Dec. 5, 1895. In a signal box, the combination with a normally unwound signaling mechanism, of a device for locking the wheel-work, connections therewith for releasing the wheel-work, both by the box-pull and by an auxiliary magnet, and contacts by which the circuit of the auxiliary magnet is opened, which contacts are closed by the winding movement of the driving-spring.

568,346. TELEPHONE MECHANISM; J. L. Given, Stony Point, N. Y. App. filed Dec. 6, 1896. In combination a telephone transmitting and receiving mechanism, a lock mechanism controlling access to or use of said telephone mechanism, a plurality of recording devices adapted to be operated by different keys, each of which operates said lock, whereby the holders of separate keys will individually record their use of the telephone mechanism.

568,350. ALTERNATING-CURRENT ELECTRIC MOTORS; F. S. Hunting, Fort Wayne, Ind. App. filed Aug. 31, 1892. An alternating-current motor having a closed secondary circuit and means for varying the phases of the E. M. Fs. developed in different parts of said circuit.

568,370. ELECTRIC ALARM FOR STEAM GAUGES; A. Ransom and A. J. Corrothers, Wise, West Va. App. filed Jan. 25, 1896. The combination in a steam gauge, of a high and low pressure electrical alarm which consists of a segmental gear which operates in connection with a pinion which is mounted on the shaft of a pointer or indicator, a curved steam-operated spring connected with the head of said gear, a metal spring which is secured to the casing of the gauge and provided with two ends, each of which projects inwardly and one adjacent to each side of said gear, an electrical conductor which connects the heads of said gear with the binding post, which is provided with a conductor which leads to an alarm-bell and said metal spring being also secured to said casing by means of another binding-post which is provided with a conductor which connects with a battery or other electrical supply, and high or low pressure-adjusting devices which operate in connection with said metal spring.

568,374. SIGNALING BY MEANS OF LIGHTS; L. Sellner, Vienna, Austria-Hungary. App. filed Nov. 19, 1895. A night-signaling apparatus comprising a signaling element composed of two normally obscured signal-lights of unlike color, and screens adapted to alternately expose said lights to view, or to continuously or intermittently expose the same.

568,385. RAIL-BOND; F. H. Underwood, Auburndale, and F. H. Daniels, Worcester, Mass. App. filed April 7, 1896. In a rail-bond, the combination with the end of the bond-wire or conductor, of the terminal, adapted to extend through an opening in the rail, and provided with two openings or holes therein, contiguous to each other, one hole for the end of the bond-wire or conductor, and the other for a drift-pin.

568,408. MEANS FOR ATTACHING OR DETACHING ELECTRIC LIGHT GLOBES; F. W. Mayer, Hartford, Conn. App. filed June 26, 1896. A device for attaching and detaching electric light globes, comprising a semi-circular band, both of said bands being connected together and adapted to engage an incandescent lamp at relatively remote points in its length, and a pole or handle secured to said device.

568,413. BRUSH HOLDER; S. H. Short, Cleveland, O. App. filed Oct. 29, 1895. In a brush holder, an adjustably-mounted, brush-supporting board of suitable non-conducting material arranged between the brush and the end of the motor armature.

568,414. ARMATURE WINDING; S. H. Short, Cleveland, O. App. filed April 20, 1896. An armature coil having side and end portions provided with paper insulation, and said end portions provided with tape insulation.

568,415. FLAT WINDINGS FOR ARMATURES; S. H. Short, Cleveland, O. App. filed May 4, 1896. An armature winding comprising a flat bar provided with an edgewise bend to form parallel arms, the flat sides of which lie in the same plane, said arms being deflected laterally in opposite directions

away from said bend and out of parallel relation, and each provided with a sidewise bend into parallelism to form the side portions of the winding frame, the free ends of said side portions provided with a bend to bring the same into proper position to be coupled to the commutator segments.

568,423. ANNUNCIATOR; C. E. Beach, Binghamton, N. Y. App. filed Aug. 16, 1895. A magnet, an arm or armature mounted on a revoluble part to rotate therewith, and having an independent vibratory motion in the direction of said magnet, said arm or armature being adapted to engage its free end with a ledge or other projecting part.

568,430. ANNUNCIATOR TIME CALLER FOR RAILROAD TRAINS; J. J. Cowhig, Manasses, Va. App. filed Feb. 25, 1896. A board provided with an alarm bell, clock-face and hands, and lettered side-paddles; magnets secured to the board near its upper end, sockets secured to the said board near its centre, a lettered drop-board hinged to the said board, and having on its rear face an armature, and on its front face pins, said armature adapted to contact with the magnets and said pins adapted to contact with the said sockets, the whole being operated by an electric battery, wires and switch.

568,444. ELECTRIC WEATHER INDICATOR; W. M. Kelch, Dayton, O. App. filed Nov. 21, 1894. In an electric weather-indicator, the combination with electromagnets and two armature levers bearing ratchet pawls thereon, of a ratchet wheel and an index pointer fixed to a shaft adjacent to one of said armature levers, an auxiliary ratchet wheel and a cam, fixed to a sleeve, said sleeve being loosely mounted on a shaft adjacent to the other armature lever, a ratchet pawl pivoted adjacent to said ratchet-wheel to prevent a backward movement thereof, and angular pins fixed to said pawl, and to one of said armature levers, said pins having a normal bearing on the periphery of said cam, and means for electrically exciting said electromagnets to advance the pointer and to permit said pointer to return to zero.

568,447. SECONDARY BATTERY; F. King, London, England. App. filed April 10, 1896. A secondary-battery element-plate, consisting of a support or grid having perforations or passages therethrough unoccupied by the active material, active material applied to the plate and an exterior covering or envelope for the plate of an insulating or inert material, said covering or envelope being imperforated over the perforations or passages through the grid or support.

568,450. ELECTRIC SWITCH; J. E. Meek, New York, N. Y. App. filed March 20, 1896. In an electric switch, the combination of a swinging knife-blade to which the supply-current is delivered, a rotating table having its axis non-coincident with the pivotal point of the swinging knife-blade, and the contact-pieces connected with the work-circuits carried by said table.

568,451. ELECTRIC THERMOSTAT; J. E. Meek, New York, N. Y. App. filed March 29, 1896. In a thermostat, the combination of a plate of insulating material, a metal plate fastened to one side of the insulating plate, one of said plates being dished away from the other so as to form a space between two bimetallic contact-pieces adapted to approach or recede one from each other under varying conditions of temperature, located in said space, and electric connections from said contact-pieces to an exterior electric circuit.

568,452. TROLLEY WIRE SUPPORT; W. A. McCallum, Cincinnati, O. App. filed March 2, 1896. A trolley-wire supporting-ear embodying a longitudinal embracing support having a groove open at opposite sides respectively from each end toward the centre, a central diagonal slot through the bottom wall into the groove, a central head for the stem attachment, and strengthening-webs connecting the head at each side with the longitudinal groove-support.

568,458. TANDEM PARALLEL CONTROLLER FOR INDUCTION MOTORS; W. B. Potter and F. E. Case, Schenectady, N. Y. App. filed Aug. 31, 1895. In a controller for induction motors contacts and cross connections adapted to connect the motors in tandem or parallel at will, and cut-out switches arranged to cut out part of the motors without affecting the operation of the remainder.

568,459. EXTINGUISHING ELECTRIC ARCS; W. B. Potter, Schenectady, N. Y. App. filed June 20, 1896. The art of extinguishing electric arcs which consists in causing the lines of force of an arc-rupturing means to localize the arc at approximately a given point of the contacts, and then to rupture it.

568,464. CONSTANT-POTENTIAL ALTERNATING GENERATOR; C. P. Steinmetz, Schenectady, N. Y. App. filed April 30, 1894. The combination of a dynamo-electric generator, having its field excited by the resultant action of a main-exciter source, and a regulating dynamo machine in series therewith; and a field-coil on the regulating machine whose excitation is varied proportionally to the current flowing in the current of the main machine.

568,475. SYNCHRONIZING DEVICE FOR ELECTRIC CLOCKS; W. J. Cruyt, Brussels, Belgium. App. filed Jan. 7, 1895. A synchronizer comprising a shaft, a disc mounted upon the shaft having a lateral pin on the face thereof and a peripheral cam, a horizontal lever having a stud adapted to bear upon the cam, and a lateral pin, a rocking-lever having an articulated hook and an armature, a lever suspended from the rocking-lever and having superposed teeth adapted to engage the lateral pin on the horizontal lever, and a tail-piece which engages the lateral pin on the disc and an electromagnet surmounting the armature.

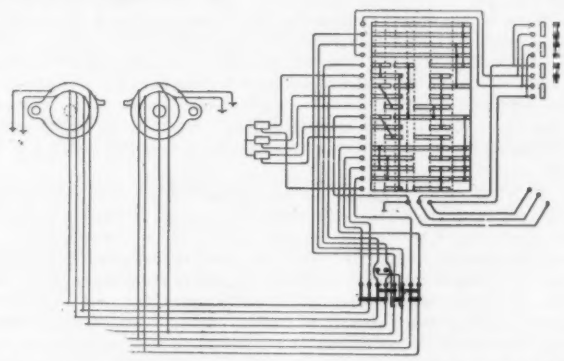
568,493. AUTOMATICALLY TESTING FIRE-ALARM CIRCUITS; L. G. Rowland, Camden, N. J. App. filed Aug. 2, 1895. In an automatic fire-signaling mechanism, the combination with a central or main battery, one pole grounded, a main loop circuit from the other pole of the main battery, said main circuit including the building to be protected, and a series of independent building loops having a common ground connection, paralleling the main line at desired points, a local or test battery in normally open circuit, and a switch device adapted to connect the local battery with the building-loops ground, and a high-resistance magnet in said last-mentioned circuit controlling an indicating device.

568,494. ELECTRIC FIRE ALARM CIRCUIT AND SIGNAL BOX; L. G. Rowland, Camden, N. J. App. filed Aug. 8, 1895. The combination with a metallic loop-circuit having a constant ground connection, the metallic circuit being of different potentials on opposite sides of said ground connection, a plurality of normally open ground connections with the metallic circuit, and devices equal in number and corresponding to said normally open ground connections with the metallic circuit adapted when operated to make and break its corresponding ground connection and the metallic circuit at that point indicating instruments upon the metallic circuit on opposite sides of the constant ground connection, and indicating devices on the constant ground connection.

568,495. FIRE ALARM CIRCUIT; L. G. Rowland, Camden, N. J. App. filed Aug. 13, 1895. In combination with a main circuit having a constant ground connection and a normally open ground and a device adapted to make and break said normally open ground, of a magnet in constant ground, a second circuit normally closed, high resistance devices in said circuit and one or more receiving devices of low resistance in said circuit, a shunt about the resistance devices controlled by the magnet in contant ground of the metallic circuit, and a relay circuit controlled by the said high-resistance device and containing a receiving device, said relay circuit being adapted to become operative when the high resistance device is de-energized.

568,506. ELEVATOR MECHANISM; H. R. Wellman, North Tonawanda, N. Y. App. filed Jan. 13, 1806. In a hoisting mechanism for elevators, the combination with a suitable frame, of a shaft journaled therein, a screw sliding upon this shaft and rotating therewith, a toothed part upon said frame and engaging with said screw, a crosshead sliding along said frame and bearing against said screw, sheaves carried by this cross head, standing sheaves journaled upon the frame, and a means for rotating the shaft.

568,512. PERFORATOR; C. L. Buckingham, New York, E. Germann and J. W. A. Gardam, Brooklyn, N. Y. App. filed Aug. 13, 1895. In a perforator, the combination of a power-driven feed mechanism, a variable feed lever engaging with said mechanism on the reverse movement of said lever, means for locking said mechanism on the completion of the said reverse movement, and an automatic releasing device operating independently of the variable feed lever to release said mechanism at each operation of the perforating mechanism.



568,458.—TANDEM PARALLEL CONTROLLER FOR INDUCTION MOTORS.

568,513. TELEGRAPH RECEIVER; C. L. Buckingham, New York, and E. Germann, Brooklyn, N. Y. App. filed May 11, 1896. The combination with a step-by-step feed or a manual controller, a positive lock or catch and means operatively connected therewith for actuating the said catch by the power applied to move the controller.

568,514. PERFORATOR AND CIRCUIT-CONTROLLING APPARATUS THEREFOR; C. L. Buckingham, New York, and E. Germann, Brooklyn, N. Y. App. filed May 11, 1896. In a perforator, the combination with a series of controlling-keys or key-levers, of a system of yielding chains or cords transverse thereto, and punch-controlling devices connected to said chains or cords.

568,515. PERFORATING MACHINE; C. L. Buckingham, New York, and E. Germann, Brooklyn, N. Y. App. filed May 11, 1896. In a punching apparatus, the combination of a punch-wheel having radially projecting punches, and a series of co-operating discs formed as a flexible band or strip.

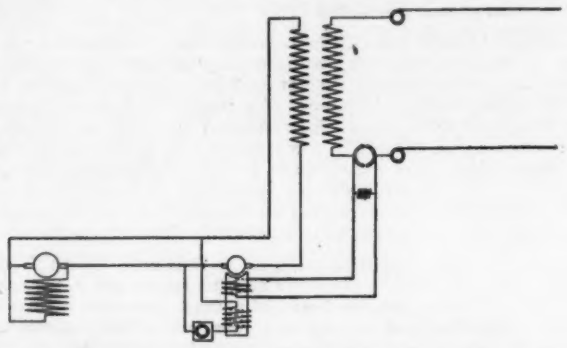
568,516. PERFORATOR; C. L. Buckingham, New York, J. Gardam and E. Germann, Brooklyn, N. Y. App. filed May 11, 1896. The combination of a series of punch-actuating magnets, a series of selecting keys for operating said punches, a paper feed and a series of feed-controlling magnets, different ones of which are brought into action by said keys according to the extent of feed required.

568,523. TROLLEY SYSTEM FOR ELECTRIC RAILWAYS; C. E. Davis, Chicago, Ill. App. filed April 27, 1896. A trolley system consisting of a series of conductors, each successive conductor taking its departure from its primary conductor at one side, and then passing to the other side of said primary conductor.

568,526. SUBSTANCE FOR TELEPHONE ELECTRODES; D. Drawbaugh, Eberly's Mill, Penn. App. filed Jan. 10, 1896. The method of preparing platinum for use at telephone electrodes, which consists in taking or preparing platinum in the form of platinum-black, agglomerating this into a suitable mass and then dividing this mass into granules or buttons.

568,527. TELEGRAPH SOUNDER; D. M. Dunn, Abingdon, Va. App. filed Jan. 27, 1896. A combined relay and sounder, comprising a relay magnet having attached to its armature a buckled plate held fixedly at one end and adapted to have its plane shifted with a click by the movement of the relay armature.

568,566. CONSTRUCTION AND OPERATION OF CIRCUIT FOR ELECTRIC MOTORS; F. E. Herdman, Winnetka, Ill. App. filed June 21, 1895. In combination with a source of current supply, a motor having armature and double field windings, independent circuits, one circuit including the armature winding and source of current supply, one field winding being in shunt with said circuit, the other circuit including the armature and other field-coil in series and independent of the source of current supply, a switch device controlling both circuits, the arrangement being such that when the switch device closes one circuit, it opens the other and *vice versa*.



568,464.—Constant-Potential Alternating Generator.

568,567. ELECTRIC ELEVATOR; F. E. Herdman, Winnetka, Ill. App. filed Oct 5, 1895. In an elevating apparatus, the combination with a car or a frame carrying a sheave or sheaves, said frame being connected to said car by cable or cables, a counter-balance frame carrying a sheave or sheaves, a motor provided with a shaft, a driving drum or sheave on said shaft, a cable passing around said driving drum or sheave and around the car-frame and counter-balance sheaves, and having its ends fixedly secured.

568,568. ELEVATOR MOTOR-CONTROLLING DEVICE; F. E. Herdman, Winnetka, Ill. App. filed Oct. 5, 1895. The combination with an elevating apparatus of an electric motor for operating the same, of a source of current supply, electrical connection between the source of current supply and field of the motor, a resistance device in said circuit, a shunt circuit to the field independent of the resistance device, said last-mentioned circuit being normally open, switches in said last-mentioned circuit, one controlled by the motor-controlling mechanism and the other in alignment with the operating mechanism and apt to be struck by said mechanism in its movement.

568,569. BRAKE MECHANISM FOR ELECTRIC ELEVATORS; F. E. Herdman, Winnetka, Ill. App. filed Oct. 5, 1895. In combination with an electric motor, a source of current supply, and a switch device for controlling the admission of current from the source of current supply to the motor, of a brake-wheel for the motor, a brake lever to operate the brake, a solenoid to the core of which the lever is connected, said solenoid being in shunt with the main circuit, and adapted to be energized when current is admitted to the motor, a sleeve resting upon said core, a connecting rod, a slot and pin connection between said rod and sleeve, a spring and weight upon said rod, operating mechanism for the motor, the connection being such that the movement of the operating mechanism in either direction from the centre elevates the connecting-rod, and toward the centre lowers the same.

568,570. BRAKE MECHANISM FOR ELECTRIC ELEVATORS; F. E. Herdman, Winnetka, Ill. App. filed Oct. 5, 1895. The combination with an electric motor, a source of current supply and motor-controlling mechanism, of a brake wheel and brake for said motor, a brake lever, a solenoid in series with the motor armature circuit, said solenoid having a wound core, said core being in shunt with the main, the brake lever being controlled by said solenoid.

568,571. BRAKE MECHANISM FOR ELECTRIC ELEVATORS; F. E. Herdman, Winnetka, Ill. App. filed Oct. 5, 1895. In combination a source of current supply, an electric motor, a brake for said motor, a brake lever to operate the brake, a solenoid having two windings, one in shunt with the main current supply to the motor, the other in series with the armature circuit, said brake lever being operated by means of the solenoid, a reversing switch, the electric connections to the series-winding being independent of the reversing switch.

568,573. BRACKET FOR ATTACHING INCANDESCENT LIGHTS TO COMPOUND GAS FIXTURES; E. C. Howe, Bridgeport, Conn. App. filed July 20, 1896. A bracket for attaching incandescent lights to the burners of compound gas-fixtures, the same comprising a sheet metal bracket having one extremity curled around to form an eye capable of being attached around such burner, suitable insulating material contained within said eye, a screw driven through the extremity of the stock of the eye into the body of the bracket, whereby said eye may be contracted or enlarged and a pair of arms extended in the arc of a circle at the other extremity of the brake, within which arms the electric light socket snugly rests.

568,577. AUTOMATIC SWITCH-ARM FOR TELEPHONE RECEIVERS; H. Marcuse, Berlin, Germany. App. filed Jan. 7, 1896. In combination with a telephone a bracket, a lever pivoted thereto and adapted to operate the receiver hook of the telephone, a receiver-arm composed of rods adjustably slidable in each other, a disc secured to one of said arms and a connection between the disc and the lever whereby when the position of the receiver-arm is changed the receiver hook is operated.

568,606. ELECTRIC SIGNALING APPARATUS; A. Garing, Carlstadt, N. J. App. filed April 21, 1896. An electric signaling apparatus comprising an electromagnet and its armature at each end of the section, and an independent signal-carrying circuit-wire leading from each electromagnet to the other end of the section, and connected with a ground contact-point adapted to be closed by the armature of the electromagnet at this other end of the section, the current passing through the said circuit-wire containing the signals being controlled by a part carried by the car.

568,608. ALARM DEVICE FOR ELECTRIC MOTORS; W. A. Gibbs, Pawtucket, R. I. App. filed Dec. 14, 1895. An alarm for an electric motor, comprising an alarm device, a source of electricity, a terminal extended through each of the field-pieces and insulated therefrom, both of said terminals being connected to one of the circuit-wires and the other of said circuit-wires being in electrical connection with the armature, which serves as a terminal to co-act with either of the first-named terminals.

568,644. SIGNALING SYSTEM FOR RAILWAYS; F. C. Timpson and R. F. Rankin, Philadelphia, Pa. App. filed Dec. 14, 1895. A system of signaling for electric and other railways, comprising the combination of a railway having turnouts, signaling stations located at each turnout, and respectively provided with two magneto-machines and two electromagnetic signaling devices, line-circuits connecting each station with the next, and respectively having branches at the near side of one and the far side of the other of each pair of stations, and whereof one branch is through the electromagnetic device and magneto-machine, and whereof the other branch is through the magneto-machine cranks or keys for said magneto-machines, mechanism operated by said cranks or keys for resetting said electromagnetic signaling devices, and means operated by said keys for opening one and closing the other of said branches to cut the electromagnetic devices into and out of circuit.

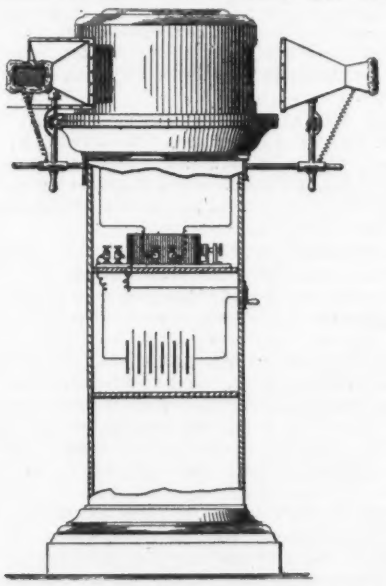
568,650. ELECTRIC TRACK CIRCUIT RAIL-JOINT; G. H. Williams, Fort Smith, Ark. App. filed March 18, 1896. A fish-plate or angle-bar having a longitudinal conductor-receiving groove extending from end to end along its upper edge.

568,668. ELECTRIC BELL; F. Davey, Detroit, Mich. App. filed Feb. 17, 1896. In a single stroke electric bell, the combination of an electromagnet, a pivoted armature, a pivoted hammer and a gong adjacent thereto, and a flexible line or strand connecting the movable end of the armature with the end of said pivoted hammer.

563,675. TELEGRAPHY; R. Grenville-Williams, Heywood, England. App. filed Oct. 5, 1895. The combination of a platinum contact roller, a drum or support, a removable conducting surface, a line circuit which includes the said roller and surface, a relay at the receiving end of the line wire, a local battery and circuit which includes the armature of the relay; and a local or receiver circuit comprising two shunt circuits and two electromagnets.

568,683. INSULATING COMPOUND; L. Honig, St. Louis, Mo. App. filed June 24, 1896. An insulating compound consisting of alcohol, shellac, powdered asbestos, glycerine, glue and wheat flour.

568,713. RAIL-BOND FOR ELECTRIC RAILWAYS; C. C. Benson, Covington, Ky. App. filed Dec. 1, 1894. An improved rail-bond for electric railways, consisting in a conducting wire, carried at opposite ends through the webs of abutting rails in split thimbles having flanged heads, the electrical contact joint being formed by driving the thimble to intimate contact of its flanged head with the external surface of the rail, and then expanding the thimble radially against the inclosed wire and the inclosing rail-web by upsetting longitudinally to form an opposite retaining head.



568,720.—Röntgen-Ray Exhibition Apparatus.

568,720. RÖNTGEN-RAY-EXHIBITION APPARATUS; A. A. Hamerschlag, New York, N. Y. App. filed May 20, 1896. In an apparatus for exhibiting Röntgen-ray effects, the combination of a box or casing, one or more fluorescent tubes therein, heads or supports adjustably supported upon the box or casing, and one or more fluoroscopes or eyepieces hinged to said heads or supports.

568,721. ELECTRIC ARC LAMP; W. Jandus, Cleveland, O. App. filed March 5, 1896. In an arc lamp the combination with a shell of a pole-piece depending into the upper portion of said shell, the lower end of the shell forming a cylinder, a coil encircling said pole-piece, an armature adapted to enter said coil and terminate at its lower end in said cylinder, and a piston secured to the lower end of said armature and operating in said cylinder.